



START2

Superfund Technical Assessment and Response Team 2 -
Region VIII



United States
Environmental Protection Agency

Contract No. 68-W-00-118

SITE REASSESSMENT

RICO-ARGENTINE
Rico, Dolores County, Colorado

TDD No. 0305-0014

NOVEMBER 14, 2003



URS

OPERATING SERVICES, INC.

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11/14/2003

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**SUBJECT: START2, EPA Region VIII, Contract No. 68-W-00-118, TDD No. 0305-0014,
Site Reassessment, Rico-Argetine, Rico, Dolores County, Colorado**

Dear Luke:

Attached are four copies of the final Site Reassessment for the Rico-Argetine site in Dolores County, Rico, Colorado. Revisions have been made in accordance with the comments on the draft report. This document is submitted for your approval.

If you have any questions, please call me at 303-291-8202.

Very truly yours,

URS OPERATING SERVICES, INC.



Bev Halwa
Environmental Scientist

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SITE REASSESSMENT

RICO-ARGENTINE

Rico, Dolores County, Colorado

CERCLIS ID# COD980952519

**EPA Contract No. 68-W-00-118
TDD No. 0305-0014**

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**SITE REASSESSMENT
RICO-ARGENTINE
Rico, Dolores County, Colorado**

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1.0 INTRODUCTION

This Site Reassessment of the Rico-Argentine site in Rico, Dolores County, Colorado (CERCLIS ID # COD980952519), has been prepared to satisfy the requirements of Technical Direction Document (TDD) No. 0305-0014 issued to URS Operating Services, Inc. (UOS) on May 23, 2003, by the Region VIII office of the U.S. Environmental Protection Agency (EPA). This report has been prepared in accordance with the EPA "Guidance for Performing Site Inspections Under CERCLA," Interim Final, September 1992, the "Region VIII Supplement to Guidance for Performing Site Inspections Under CERCLA", and the "Hazard Ranking System Guidance Manual" (U.S. Environmental Protection Agency (EPA) 1992a; EPA 1993b; EPA 1992b. No field work was conducted.

2.0 OBJECTIVES

The purpose of this site reassessment is to review data pertinent to the evaluation of the Rico-Argentine site with regard to the EPA's Hazard Ranking System (HRS) criteria (Office of the Federal Register 1990). The specific objectives of this reassessment were to:

- Conduct interviews, as appropriate, and gather existing data;
- Review and document existing data; and
- Identify data gaps.

3.0 BACKGROUND INFORMATION

3.1 SITE LOCATION AND DESCRIPTION

The Rico-Argentine site is located in the Rico Mountains of southwestern Colorado. The Rico-Argentine site, as defined for this site reassessment only, includes the locations of inactive mining and milling operations in two drainages, the Dolores River and its tributary Silver Creek. The site includes the town of Rico, Colorado. The site extends northeast up the Silver Creek drainage to the current municipal drinking water intake for the town of Rico on Silver Creek, and north along the Dolores River drainage to Peterson Slide, upgradient of the settling ponds, the St. Louis tunnel, and the location of the proposed municipal drinking water intake for Rico. The site is located in eastern Dolores County, Colorado (Figures 1 and 2). The legal description of the site is the southeast quarter

of Section 25, T. 40 N, R. 11 W. The site is located between 37° 43' 45" and 37° 40' North latitude and 108° 00' and 108° 3' 45" West longitude (Walsh Environmental Scientists and Engineers, Inc. (WALSH) 1995). The Rico-Argentine site can be reached by proceeding south from Telluride, Colorado, on State Highway 145 over Lizard Head Pass for 24 miles to the town of Rico, or by proceeding north from Cortez, Colorado, on State Highway 145 for 47 miles to the town of Rico (URS Consultants, Inc. (URS) 1996).

The area surrounding the Rico-Argentine site is primarily U.S. Forest Service land located within the San Juan National Forest, with surrounding peaks reaching 14,000 feet above mean sea level (msl) and summits in the local Rico Mountains reaching more than 12,000 feet above msl. The town of Rico and the settling ponds along the east bank of the Dolores River are at 8,800 feet above msl and the Rico-Argentine Mill and tailings along Silver Creek are at 9,200 feet above msl (U.S. Geological Survey (USGS) 1960).

The Rico-Argentine site includes the locations of the inactive mining and milling operations in the drainages of the Dolores River and its tributary, Silver Creek. The St. Louis tunnel, the previous location of a sulfuric acid plant and two cyanide heap leach basins, a series of settling ponds, and two ponds fed by geothermal discharge from drill holes are located along the east bank of the Dolores River approximately ¼ to ¾ miles north of the town of Rico and occupy about 80 acres (Figure 2). Some of the water from the underground mine workings associated with the Rico-Argentine site drains from the mines to the St. Louis tunnel, where it flows into the settling pond system prior to discharging into the Dolores River (URS 1996). The Argentine tailings, the inactive Rico-Argentine mill site, and the Blaine adit are located on Silver Creek (URS 1994). The water from the Blaine adit was diverted through a series of underground workings into the St. Louis tunnel.

3.2 SITE HISTORY AND PREVIOUS WORK

The information provided below was obtained primarily from previous reports and all sources are referenced.

The Rico area has an extended mining history and a detailed account can be found in the URS Consultants, Inc. (URS) Site Inspection Prioritization Report or the Rico Mining Area Summary of Environmental Data by ESA Consultants, Inc. (ESA) (URS 1994; ESA Consultants, Inc. (ESA)

1995). Operations in the Rico Argentine area began more than 100 years ago with silver production. The major interests of the now inactive mining operations consisted of precious metal mining, base metal production (lead, zinc, and copper) from sulfide ores, and sulfuric acid production from pyrite ores (ESA 1995).

Early mining activity in the Rico area began in the 1860s when several claims were staked in the Pioneer District at the confluence of Silver Creek with the Dolores River. Silver production reached a peak in 1893 and the population of Rico grew to 12,000. Mines in the area produced gold, lead, zinc, and copper in addition to silver. In the early 1900s, mines began producing base metal ores. The Rico-Argentine Mining Company was formed to produce base metals. A custom mill was built in 1926 by the International Smelting Company, a subsidiary of Anaconda Minerals Company (Anaconda). Base metal ore production peaked in 1927 but by 1928 the mill had shut down and by 1932 all mining activity in the area had ceased (URS 1994; USGS 1974).

The Rico-Argentine Mining Company resumed sporadic mining activities in 1934 and resumed steady production in 1939 with the operation of the lead-zinc-copper Argentine Mine along with the Argentine Mill (ESA 1995; Colorado Department of Natural Resources, Bureau of Mines (BOM) 1939a; BOM 1939b). By 1955, the crosscut from the Argentine Mine on Silver Creek to the St. Louis tunnel on the Dolores River was completed, reducing the impact of drainage at the Silver Creek site but increasing the flow at the St. Louis tunnel (USGS 1974). A sulfuric acid plant located north of the settling ponds along the Dolores River was operated between 1955 and 1964 (ESA 1995; USGS 1974). All mining operations again ceased in 1971 (ESA 1995; BOM 1971).

The Rico-Argentine Mining Company built a 300-foot by 500-foot leach pad next to the old sulfuric acid plant in 1973. A cyanide solution was used to leach silver and gold from raw ore (BOM 1974). In 1975 an additional cyanide leach pad was constructed in a settling pond originally used by the acid plant (BOM 1975). This plant was closed in 1975 because of a release of untreated water to the Dolores River. A Colorado Discharge Permit System (CDPS) permit, permit number CO-0029793, was issued to Rico-Argentine Mining Company in 1976 for the St. Louis tunnel discharge of process and storm water into the Dolores River (ESA 1995; Colorado Department of Public Health and the Environment (CDPHE) 1993). The Colorado Division of Minerals and Geology has no record of mining permits in the Rico area since 1976 (Colorado Department of Natural Resources, Division of Minerals and Geology 2003).

Anaconda came under control of about 7,500 acres in the early 1980s and implemented an exploratory drilling program for molybdenum. In 1984, Anaconda began operation of a lime addition plant with a series of settling ponds to treat the St. Louis tunnel drainage before releasing it to the Dolores River. A new lime-slaking facility was added in 1986. In addition, the acid plant was demolished and the site graded, capped and vegetated. Dredged tailings from the upper ponds were stored in a basin built where the leach pad had been (ESA 1995). In 1988 Anaconda sold its property around the Rico area to Rico Development Corporation (RDC) (Anderson Engineering Company, Inc. (Anderson) 1997). The CDPS permit was modified to transfer ownership to RDC.

A Site Inspection Report was compiled in 1984 for EPA and the site was identified as a potentially hazardous site (Ecology and Environment (E&E) 1984). As part of an EPA Preliminary Assessment/ Site Inspection, surface water and sediment samples were collected from Silver Creek and the Dolores River in November 1984. Surface water sample analytical results indicated a decrease in leachate concentrations downgradient of the Silver Creek tailings ponds while sediment sample results documented metals found in samples collected at the locations of previous mining operations indicating that metals may have been precipitating out of solution or were being transported elastically (E&E 1985). Elevated concentrations of arsenic, cadmium, copper, iron, lead, manganese, and zinc were detected during the investigation (E&E 1985).

In a 1991 Preliminary Assessment of McPhee Reservoir, 36 miles south and downgradient of Rico, analytical results for tissue samples of black crappie and largemouth bass taken from the reservoir, a fishery, exceeded the Colorado Department of Public Health and the Environment (CDPHE) levels of 0.5 parts per million (ppm) mercury contamination. These samples also exceeded the Superfund Chemical Data Matrix (SCDM) food chain Reference Dose Screening Concentration (RDSC) of 0.41 ppm (EPA 1996). In the 1991 Preliminary Assessment, potential sources of contamination were identified as 150 to 200 upgradient mines, three downwind area power plants, and the natural background mercury occurrence. At the McPhee Reservoir, the mercury content of sedimentary rocks that comprise 90 percent of the surface area of the Colorado Plateau region ranges from less than 10 parts per billion (ppb) to greater than 10,000 ppb. Mercury was used for a short time as amalgam in mill processing in Rico (USGS 1970; E&E 1991).

The U.S. Department of Interior Bureau of Reclamation conducted surface water and sediment sampling in the Dolores River and its tributaries between 1989 and 1993. The results show Silver

Creek to be a major, but not the only, source of mercury and other heavy metals in the upper Dolores River Basin (U.S. Department of the Interior, Bureau of Reclamation (BOR) undated).

A 1994 Site Inspection Prioritization conducted by URS for EPA identified data gaps with respect to the HRS including source characterization, wetlands delineation and sampling, residential soil sampling, and target analysis (URS 1994). An Expanded Site Inspection was conducted in 1994 to acquire additional site data (URS 1996).

Phase I and Phase II Environmental Assessments were conducted by Walsh Environmental Scientists and Engineers, Inc. (WALSH) and completed in 1995 as part of the 1994 sale of property to Rico Properties, LLC, Rico Renaissance, and Rico Mountain Life (RP *et al*). Claims and residential lots in town were mapped and categorized as to environmental risk. Some properties within Rico were identified as having been impacted by past mining activities and by mine waste used as fill material. Releases of contaminants from mine sites were observed. Lead was detected at concentrations ranging from 20 milligrams per kilogram (mg/kg) to 12,000 mg/kg, detections of cadmium were 3 mg/kg to 84 mg/kg, detections of mercury were 0.3 mg/kg to 16 mg/kg, and detections of copper were 9 mg/kg to 660 mg/kg (WALSH 1995).

The Atlantic Richfield Corporation (ARCO) initiated a voluntary cleanup action of five source areas around the town of Rico and the surrounding area within the framework of the Colorado Voluntary Cleanup and Redevelopment Act (Figure 3). The five areas included the Argentine Tailings, Columbia Tailings, Santa Cruz Mine, Silver Swan Mine, and Grand View Smelter. According to the construction completion report, the Voluntary Cleanup (VCUP) activities occurred between July and November 1996 and included removal of waste rock and tailings material from active waterways and drainages; reconfiguration, consolidation, and stabilization of waste rock and tailings piles to minimize erosion and eliminate slope instability; implementation of source controls to reduce the generation or transport of dissolved metals; capping and erosion protection to minimize the potential for direct human exposure to mill tailings and mine waste rock; and construction of passive treatment features to reduce current metal loadings from adit discharge to receiving waters (Anderson 1997). Following the completion and a two-year surface water monitoring program, ARCO requested a No Action Determination from the CDPHE Hazardous Materials and Waste Management Division (HMWMD). Since the VCUP actions covered only a portion of the Rico-Argentine site listed in

CERCLIS, EPA determined that Superfund activities at the site could not be suspended (EPA 2000b).

A Compliance Sampling Inspection related to the CDPS permit was conducted by EPA Office of Enforcement, Compliance, and Environmental Justice, Technical Enforcement Program, in June 1998. St. Louis tunnel Outfall 002 was sampled and results indicated that the permit was being violated (EPA 1998a).

A biological and aquatic survey along the Dolores River corridor was conducted in 2000 by Aqua-Hab Inc. (AHI) for the town of Rico that included a wetlands inventory using the 1987 Army Corps manual protocol (Aqua-Hab Inc. (AHI) 2001).

An EPA Emergency Removal Action was conducted in April 2000 when one of settling ponds at the St. Louis tunnel overflowed into the Dolores River releasing metals to the surface water. The embankment was reinforced and a culvert added. In a sludge sample collected from the uppermost pond, cadmium was detected at 115 ppm, lead at 1,180 ppm, arsenic at 48.4 ppm, zinc at 23,700 ppm, and beryllium at 19.2 ppm (EPA 2000a; URS Operating Services, Inc. (UOS) 2000).

After the sale of the property containing the St. Louis tunnel, lime treatment system, and settling ponds to RDC by Anaconda, operation of the lime plant continued. In 1994 RDC commenced the sale of the property to RP *et al*, and in September 1996, RDC ceased operations of the treatment system and ceased the water sampling and monthly reporting that is required under the CDPS permit. Reports indicate that even while in operation, the lime treatment was not sufficient to meet CDPS permit requirements for the effluent from the St. Louis tunnel (EPA 1998b). Geothermal discharges from wells drilled during mining exploration were observed flowing into some of the settling ponds. Pond berms eroded and untreated discharge flowed directly into the Dolores River. A non-permitted discharge from the Blaine adit on Silver Creek was also observed flowing into Silver Creek during this period (URS 1996).

In addition to the prior violations noted above, since 1990 the CDPS permit levels have been violated on numerous occasions. Notices of Violation (NOV) and Cease and Desist Orders (CDO) were issued by the Colorado Department of Health (now known as the CDPHE) in 1990, 1993, 1994, and 1996. Whole effluent tests, required as a control strategy related to the 304(1) listing, were failed

repeatedly. Discharge Monitoring Reports for Outfall 002, required by the CDPS permit, were delinquent or incomplete (CDPHE 1995). Adequate steps were not been taken to comply with permit requirements. EPA records indicate that from January 1992 through May 1998, approximately 96 violations occurred at RDC's mine in Dolores County (EPA 1998b). The EPA and the state of Colorado filed suit against RDC *et al* and that suit is pending (EPA 2000c). Table 1 contains analytical results that formed the primary basis for the litigation (EPA 1998b; URS 1996; Camp Dresser & McKee (CDM) 1992; CDM 1993a; CDM 1993b; CDM 1993c; EPA 2003c).

A study to evaluate treatment options for Blaine adit and St. Louis tunnel was conducted by J. E. Reynolds & Associates in 2000 (J. E. Reynolds & Associates 2000). In 2001, ARCO funded a Water Quality Assessment (WQA) to be completed by State of Colorado Water Quality Control Division to determine assimilative capacities for receiving streams currently and also under a new treatment facility (Atlantic Richfield Company (ARCO) 2001). ARCO provided comments to the WQA in August 2002 and CDPHE responded to those comments in 2003. (ARCO 2002; CDPHE 2003a). The conclusion of the WQA is that during low flow conditions, the assimilative capacity for zinc is exceeded by 31.6 pounds per day (lbs/day) and treatment must be accomplished at all seven identified point sources to meet zinc discharge limitations (CDPHE 2003a; ARCO 2002; CDPHE 2002b).

A Targeted Brownfields Assessment (TBA) was conducted by CDPHE of the North Rico Light Industrial Park and Maintenance Barn sites in 2002. The North Rico Light Industrial Park is located upgradient of the settling ponds east of the Dolores River. The area is proposed for development by Rico Renaissance for light industrial and commercial uses. The County Maintenance Barn is located in the town of Rico on the east side of the Dolores River. This property is proposed for redevelopment as a hotel (CDPHE 2003a).

The Citizens For Accountability and Responsibility conducted a water quality study of the Dolores River in 2002 under the EPA Office of Environmental Justice's Community Organization Summer Intern Program. Field analytical results indicated high zinc levels in the Dolores River (Citizens For Accountability and Responsibility (CFAR) 2002).

Organic contaminants were also identified in various reports, such as leaking underground storage tanks (USTs), pesticides in residential yards, petroleum hydrocarbon contamination related to the

highway department facility, and asbestos-containing buildings (WALSH 1995; URS 1996; CDPHE 2003a).

3.3 SITE CHARACTERISTICS

3.3.1 Geology

The geology of the Rico District is extremely complex. The dominant structure of the district is a faulted dome centered on a monzonite stock. Sedimentary strata exposed in the area are of the Ouray and Leadville limestones, overlain by the Hermosa Formation. The youngest sedimentary strata in the Rico-Argentine District is the red beds of the Cutler Formation. The lower slopes of the Rico District are generally covered by debris resulting from wash, talus, and landslide processes (USGS 1974). Surface materials in the valley sides and bottoms are glacial or stream deposits (URS 1996).

The ore bodies in the town of Rico are relatively near surface as the mine workings are not developed at great depth, and one, the Atlantic Cable Mine, was sunk on outcropping mineralization. A gossan deposit can be observed northeast of the town, which represents the ferruginous deposit of the upper oxidized portion of the sulfide vein. The predominant ore deposits of the Rico-Argentine site consist of 1) massive sulfide replacement deposits in limestone of the Hermosa; 2) contact metamorphic deposits of the sulfides, specularite, and magnetite in limestones and 3) veins in fractures and small faults in lower Hermosa sandstones and arkoses (USGS 1974). The most abundant sulfide mineral is pyrite (iron sulfide). Other common sulfide minerals are sphalerite (zinc sulfide), and galena (lead sulfide) (CDPHE 1996).

Bedrock units underlying the town of Rico include the middle member of the Hermosa Formation, Leadville Limestone, Lawson Latite Porphyry, and the Uncompahgre Quartzite. The middle member of the Hermosa is composed of interbedded limestone, arkosic sandstone, and shale. There are intermittent outcrops of the Precambrian Greenstone. A wedge of coarse alluvial/colluvial valley fill is found in the Dolores and Silver Creek drainage basins (CDPHE 1996).

3.3.2 Hydrogeology

A shallow unconfined aquifer is located in the glacial, stream, wash, talus and landslide debris found along the valley floors. Groundwater levels in the shallow aquifer would be greatly influenced by seasonal weather conditions and the nearby surface water bodies. Conductivity is assumed to be high, between 10^{-2} to 10^1 centimeters per second (cm/sec) (USGS 1987). Groundwater flow is expected to follow the valley contours (URS 1996).

Deeper bedrock aquifers are found at the site. Several exploratory drill holes along the Dolores River portion of the site produced flowing water and some were capped (Anaconda Minerals Company (Anaconda) 1988; Anaconda 1994; URS 1996). Several underwater geothermal springs are found along the Dolores River. Water quality data collected during the 1995 URS field investigation from the two discharging drill holes indicate a common source. Water flowing from these drill holes is depositing calcium carbonate and iron around the drill holes and there are visible deposits between the drill holes and the town of Rico along the Dolores River (URS 1996).

3.3.3 Hydrology

The Rico-Argentine site is located in the Dolores River Basin. The Dolores River and its tributary Silver Creek are the major surface water bodies in the area. The Dolores River flows to the south past the proposed municipal drinking water intake for Rico, the St. Louis tunnel, the site of the old sulfuric acid plant and cyanide heap leach basins, tailings piles, settling ponds, and the CDPS Outfall 002. Silver Creek flows from the east, past the current municipal drinking water intake for Rico, the old mill site and several tailings piles, and through the town of Rico before joining the Dolores River west of Rico. The 41-year annual mean flow on the Dolores River, approximately four miles below the town of Rico, is 136 cubic feet per second (cfs) and the upstream drainage basin encompasses 105 square miles (Appendix A) (USGS 1993). The flow rate of Silver Creek is approximately 10 cfs. and the upstream drainage basin of Silver Creek encompasses an estimated seven square miles (Figure 2) (USGS 1976; URS 1996; USGS 1994).

3.3.4 Meteorology

The Rico-Argentine site is located in a semiarid climate zone. The mean annual precipitation, as totaled from the University of Delaware (UD) database, is 12.8 inches. The net annual precipitation as calculated from precipitation and evaporation data obtained from the UD is 4.1 inches (University of Delaware (UD) 1986). The University of Delaware database calculates the precipitation based on an average of gauging stations determined by the latitude and longitude. According to monthly digital precipitation data from the National Weather Service (NWS) from 1910 to 1992, annual precipitation at a gauging station located south of Rico ranged from 15.07 to 44.03 inches per year (Appendix A) (National Climatic Data Center (NCDC) 2003). The 2-year, 24-hour rainfall event for the site is approximately 1.5 inches (Dunne and Leopold 1978).

4.0 PREVIOUS ANALYTICAL DATA

Data review is limited to inorganic data because organic contaminants found in various studies can not be attributed to previous mining activities (URS 1996; CDPHE 2003c; WALSH 1995; UOS 2000). Data from October 1996 forward reflects the conditions after completion of the VCUP activities. This is because the VCUP activities were designed, in part, to improve ambient water quality. Pre-VCUP data may not be reflective of current ambient water quality; however, VCUP activities did not affect ambient water quality in Silver Creek above the confluence of the tributary containing the Argentine tailings seep and also did not affect the ambient water quality in the Dolores River above the confluence of Silver Creek. According to HRS Guidance, conditions that existed at the time of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site investigation, conducted in September 1995 by UOS, may be used to evaluate the site using the HRS (Office of the Federal Register 1990; URS 1996).

A review was conducted of previous analytical data, primarily data collected since 1995. In many cases, as noted in the detailed discussions that follow, the quality of the data is not known. Analytical methods varied or were not noted in reports. Except where data were collected according to HRS guidelines, data do not appear to have been validated and are, therefore, of unknown quality. A determination of data quality may be possible after a review of the complete laboratory packages. Those packages were not available for this site reassessment. Without the laboratory packages, Sample Quantitation Limits (SQLs), required for evaluation using HRS guidelines, can not be calculated.

In cases where the data were validated using the HRS guidelines for analytical interpretation, the following notation is used (Office of the Federal Register 1990). Elevated concentrations of contaminants reported as significantly above upgradient contaminant values are noted by a star (★) in two cases. The first is when the upgradient analyte concentration is greater than its SQL, and if the release sample analyte concentration is greater than its SQL, three times greater than the upgradient, and five times greater than the blank concentration. The second is when the upgradient analyte concentration is not greater than its SQL and if the release sample analyte concentration is greater than its SQL, greater than the upgradient SQL, and five times greater than the blank analyte concentration. If validation has occurred, data are acceptable for use unless qualified in the data table.

5.0 SOURCE CHARACTERIZATION

Several mine sites have been identified in or very near the Dolores River drainage or the Silver Creek drainage. In addition tailings and/or waste rock may have been moved into the town of Rico as street cover (URS 1994). During a 1984 site inspection, a total of 400,000 tons of source material were estimated to be in the Rico-Argentine area. Waste quantity was not documented by specific location (E&E 1984; EPA 1993a).

A draft WQA was completed in 2001 by the CDPHE Water Quality Control Division based on data available from seven point source discharges to surface water within the three miles of the Rico-Argentine Mine area (Figure 2). During low flow conditions, the maximum assimilative loading capacity for zinc was determined to be 4.95 lbs/day. A total of 35.60 lbs/day of zinc were calculated as being contributed by the seven point sources: St. Louis tunnel/St. Louis ponds (17.81 lbs/day), Blaine adit (which has been recently repaired), (8.01 lbs/day), Argentine seep (3.75 lbs/day), Columbia tailings seep (4.81 lbs/day), Rico Boy adit (0.39 lbs/day), Santa Cruz adit (0.35 lbs/day), and Silver Swan adit (0.48 lbs/day). The findings indicate that under the current circumstances of limited dilution, treatment must be accomplished at all locations in order to meet CDPHE WQCD zinc limitations. The Argentine seep discharges to a tributary to Silver Creek (CDPHE 2003b). The discharge from St. Louis tunnel, which combines with surface runoff, is routed through a series of settling ponds before discharging to the Dolores River. The Columbia tailings seep discharges to a side channel of the Dolores River. The Santa Cruz adit, Rico Boy adit, and Silver Swan adit discharge to wetlands that drain to the Dolores River (CDPHE 2002b).

Source characterization of these and other source areas has occurred during a number of studies including the 1995 Expanded Site Inspection, the 1998 EPA Compliance Inspection, the 2000 EPA Emergency Response Removal Action, the 2000 ARCO sampling, and a 2003 CDPHE TBA. Not all source areas have been mapped using a Global Positioning System (GPS) (EPA 1998a; URS 1996; ESA 2000; CDPHE 2003c).

5.1 1996 EXPANDED SITE INSPECTION

Source samples were collected from the two abandoned cyanide leach pits along the Dolores River, a spring flowing from beneath the abandoned cyanide leach pits, the St. Louis tunnel outfall, the hot-tub fed by discharging drill holes, the uppermost settling pond, the lowermost settling pond, the drainage ditch between the upper settling ponds and the Dolores River, stained soil adjacent to a fuel tank at the mill site, the tailings piles along upper Silver Creek just below the old mill building, tailings at the confluence of Silver Creek and the Dolores River, and from two tailings piles along the Dolores River south of Rico, as shown in Figure 4. Samples were analyzed through the EPA Contract Laboratory Program (CLP) and data were validated and are acceptable for HRS use as qualified (URS 1996).

Analytical results for source inorganics are in Tables 2 through 4. Background for cyanide in the Rico area is approximately 0.5 ppm (RS-SO-01 in Table 17 and on Figure 4). Concentrations of cyanide detected in source sediment/soil samples from the uppermost cyanide leach pit (RS-WSO-01, 4.6 mg/kg), the tailings piles along Silver Creek (RS-WSO-03, 4.2 mg/kg and RS-WSO-04, 5.4 mg/kg), and the uppermost settling pond (RS-WSW-01, 3.1 mg/kg) were significantly greater than concentrations detected in the background sample (URS 1996).

Analytical results for source samples also documented concentrations above the background for aluminum, antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, thallium, and zinc. The analytical results were generally between approximately two to ten times background and are characteristic of mining waste material. Detected concentration of cadmium, calcium, copper, iron, lead, silver, and zinc in tailings piles along Silver Creek and the Dolores River were five to ten times background levels (Table 2) (URS 1996).

High concentrations of calcium were found in the settling ponds as expected since calcium was used in the water treatment process to reduce the acidity of the mine water outfall (Anaconda 1994). Sediment in the uppermost (first) settling pond contained elevated concentrations of aluminum, antimony, arsenic, cadmium, calcium, copper, and lead; and the aqueous sample from the uppermost settling pond contained elevated levels of calcium and copper (Table 3) (URS 1996).

5.2 1998 EPA COMPLIANCE INSPECTION

During a June 1998 Compliance Sampling Inspection related to CDPS permit No. CO-0029793, EPA Office of Enforcement, Compliance, and Environmental Justice Technical Enforcement Program, sampled Blaine adit Outfall 001 and St. Louis ponds Outfall 002. Results indicated that the CDPS permit was being violated. All samples were analyzed in accordance with 40 CFR part 136 (EPA 1998c). As shown in Table 5, cadmium, copper, lead, and zinc were detected at concentrations above SCDM freshwater Ambient Water Quality Criteria (AWQC) benchmarks. Note that the concentrations detected in Outfall 001 are significantly higher than those in Outfall 002 (EPA 1998a). The water from the Blaine adit was redirected through underground workings to the St. Louis tunnel; no data are available regarding breaches to the channeling system; however, it is suspected that this may be occurring (CDPHE 2003b).

5.3 2000 EPA EMERGENCY RESPONSE REMOVAL ACTION

During a 2000 EPA Emergency Response Removal Action, samples were collected from surface water and sediment of the upper settling ponds. The analytical results are in Tables 6 and 7 and sample locations are shown on Figure 5. Analytical data were reviewed by a chemist and the quality of all data, except selenium, appears to be acceptable for the intended use. Laboratory data may be available for validation and SQL calculation (UOS 2000).

5.4 2000 AND 2002 ATLANTIC RICHFIELD SAMPLING

Samples were collected for ARCO by ESA in June 2000. Surface water analytical results for samples collected for dissolved and total metals from St. Louis tunnel discharge, St. Louis ponds, Outfall 002, a drill hole geothermal discharge, and the Blaine adit are listed in Table 8. Analytical methods are also provided; the data do not appear to have been validated. SCDM AWQC

benchmarks for cadmium, copper, iron, lead, and/or zinc were exceeded in all samples as highlighted in Table 8. Sample locations are shown on Figure 6 (ESA 2000).

Samples were collected for ARCO by Short Elliott Hendrickson, Inc. in July and October 2002. Source water analytical results for samples collected for dissolved and total metals from the Columbia Tailings seep, the Silver Swan adit, the St. Louis tunnel discharge and Outfall 002 are listed in Tables 9 and 10. Analytical methods are also provided; data do not appear to have been validated. SCDM AWQC benchmarks for cadmium, copper, iron, lead, and/or zinc were exceeded in all samples, as highlighted in Tables 9 and 10. Sample locations are shown in Figure 7 (Short Elliott Hendrickson, Inc. (Short) 2002a; Short 2002b; Short 2003).

5.5 2003 TARGETED BROWNFIELDS ASSESSMENT

Soil samples collected by CDPHE in 2003 were analyzed for the total fraction of arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and zinc. Groundwater samples collected from the Maintenance Barn area were also analyzed for Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs), pesticides, herbicides, and Diesel Range Organics (DRO). Results were validated and are acceptable for use as qualified. Ten surface soil samples and one subsurface soil sample were collected at the North Rico Industrial Park and four samples were collected from the Maintenance Barn site. Inorganic analytical results are in Table 20 and organic analytical results are in Table 25. Sample locations are shown in Figure 9. The detection limit was above a SCDM benchmark for 9 inorganic samples and a SCDM benchmark was exceeded in all other inorganic samples. The SCDM CRSC benchmark was exceeded in sample RMB-SO4 for Benzo(a)pyrene. No other SCDM benchmarks for soil were exceeded (CDPHE 2003c).

6.0 SURFACE WATER PATHWAY

Sampling of surface water with and without collocated sediment samples was conducted during a number of studies including the 1995 Phase II Environmental Site Assessment, the 1996 EPA Expanded Site Inspection, the 2000 ESA and 2002 Short Elliott Hendrickson, Inc. sampling for ARCO, the 2002 Citizens For Accountability and Responsibility study, and the 2003 CDPHE TBA. In addition surface water analytical results were summarized by PTI Environmental Services (PTI) in 1995. Also, municipal drinking water has been sampled by the Town of Rico (CDPHE 2003d).

6.1 1995 PHASE II ENVIRONMENTAL ASSESSMENT

Three surface water samples were obtained from the Dolores River, one from Silver Creek, and one from a spring near the Mountain Springs Mine. Samples were analyzed for total metals using EPA methods 6010 and 7471. Detection limits for these samples are higher than many SCDM AWQC benchmarks; data do not appear to be validated. Analytical Results are in Table 11. Sample locations are shown on Figure 8. Detection limits for water samples were not low enough to compare against SCDM benchmarks for Contaminants of Concern (COCs) including arsenic (190 micrograms per liter ($\mu\text{g/L}$), cadmium (1.1 $\mu\text{g/L}$), chromium (11 $\mu\text{g/L}$), copper (12 $\mu\text{g/L}$), mercury (0.012 $\mu\text{g/L}$), selenium (5 $\mu\text{g/L}$), silver (4.1 $\mu\text{g/L}$) (WALSH 1995; EPA 1996).

6.2 1996 EPA EXPANDED SITE INSPECTION

The surface water and sediment total metals analytical results for 11 locations for the expanded Site Inspection are presented in Tables 12 through 15. Sample locations are shown in Figure 4. Samples were analyzed through EPA CLP and were validated; analytical results are acceptable for HRS use as qualified.

6.2.1 Silver Creek

Three surface water and sediment samples, including a background sample, were collected from Silver Creek by URS in 1995 (URS 1996). The background samples from Silver Creek (RA-SW/SE-05) were collected just upstream from the Rico municipal drinking water intake (Figure 4). The total metals analytical results are presented in Tables 12 and 13 for Silver Creek. Most of the elevated concentrations of metals in sediment samples were flagged by the validator as estimated because of the dilution required before the sample could be analyzed or because quality control criteria were not met (URS 1996).

Elevated concentrations of iron, manganese, and zinc were detected in both of the downstream surface water samples (Table 12). A seep was observed flowing from beneath the tailings pile directly into the creek near the location of sample RS-SW-06. Rusty-colored iron staining was also visible near the location of sample station RA-SW-06. The rusty-colored staining was less noticeable at RA-SW-07 (URS 1996).

Elevated concentrations of copper, arsenic, iron, lead, manganese, silver, and zinc were detected in sediment sample RA-SE-06 (Table 13). Tailings at this location were observed to be slumping into the creek and the creek bed appeared to be composed entirely of fine-grained tailings material derived from the tailings piles along the creek. Elevated concentrations of arsenic, copper, iron, lead, manganese, silver, and zinc were detected at the downstream Silver Creek sample location (RA-SE-07) and were between one-half to one-tenth of the concentrations detected in the upstream location (RA-SE-06) (URS 1996).

6.2.2 Dolores River

In 1996, eight surface water samples and eight sediment samples, including a background sample, were collected from the Dolores River by URS. The background sample was collected on the east bank of the river, across from the Rico Ranger Station. The surface water total metals analytical results are in Table 14. Iron and manganese were found at elevated concentrations in all Dolores River surface water samples downstream of the background sample (RA-SW-01). Zinc was detected at elevated concentrations in samples collected downstream of sample RA-SW-02, all downgradient of the St. Louis ponds (Figure 4). The highest concentrations of iron, manganese, zinc, and copper were detected in surface water sample RA-SW-08. Iron in the sample from this location was 54 times background, manganese was 20 times background, zinc was 68 times background, and copper was 8 times background. These elevated concentrations may be attributed to the tailings located immediately upgradient of this sample location. There were also elevated concentrations of aluminum detected in samples RA-SW-02 and RA-SW-08. The concentrations detected were approximately 10 times background and there is no apparent source for these concentrations (URS 1996).

Elevated metals concentrations were detected in sediment samples RA-SE-08 and RA-SE-09 (Table 15). Both samples were collected near tailings piles that were being actively eroded by the Dolores River. Copper was detected at concentrations that were 9 times background in sample RA-SE-08 and 5.5 times background in sample RA-SE-09. Lead, manganese, and zinc were all detected at estimated quantities, below the detection limit, at elevated concentrations ranging from three to five times background (URS 1996).

6.3 2000 AND 2002 ARCO SAMPLING

Surface water samples were collected for ARCO by ESA in June 2000. Surface water analytical results for samples collected for dissolved and total metals from the Dolores River and Silver Creek are in Table 8. Analytical methods are also provided; the data do not appear to have been validated. SCDM AWQC benchmarks for cadmium, copper, iron, lead, manganese, and/or zinc were exceeded in all but the Dolores River background sample, as highlighted in Table 8. Sample locations are shown in Figure 6 (ESA 2000).

• Samples were collected for ARCO by Short Elliott Hendrickson in July and October 2002. Surface water analytical results for samples collected in July 2002 and October 2002 for dissolved and total metals from the Dolores River and Silver Creek are in Tables 9 and 10. Analytical methods are also listed; data do not appear to have been validated. SCDM AWQC benchmarks for cadmium, copper, iron, lead, and/or zinc were exceeded in all of the Silver Creek samples and seven of the fourteen Dolores River samples, as highlighted in Tables 9 and 10. Sample locations are shown in Figure 7. The upgradient sample on Silver Creek does not appear to be above all impacted mining areas and may not be an appropriate background sample for HRS evaluation (Short 2002a; Short 2002b; Short 2003).

6.4 2002 CITIZENS FOR ACCOUNTABILITY AND RESPONSIBILITY

The Citizens For Accountability and Responsibility conducted a water quality study of the Dolores River in 2002 under the EPA Office of Environmental Justice's Community Organization Summer Intern Program. Zinc measurements were made with an Aquaquant test kit from EM Science with a sensitivity of 0.1 ppm to 5.0 ppm. This field screening tool did not provide the quality of data appropriate for HRS evaluation. Results indicated high zinc levels in the Dolores River (CFAR 2002). Sample locations and results are presented in Figure 10.

6.5 2003 TARGETED BROWNFIELDS ASSESSMENT

Four surface water samples were collected for this TBA. Two surface water samples were collected from the Dolores River adjacent to the North Rico Light Industrial Park site (Figure 9). One sample was collected upgradient of the site (DR-SW1) and one downgradient of the site (DR-SW2).

Additionally, two surface water samples were collected from a small tributary of the Dolores River that appears to originate from groundwater discharge or alluvial flow along the western side of the North Rico Light Industrial Park. One sample was collected upgradient of the site (OC-SW1) and one downgradient of the site (OC-SW2), both collected within this tributary channel. All surface water samples were analyzed for the dissolved fraction of arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and zinc. Data appear to have been validated and are acceptable for HRS use as qualified. Analytical results are in Table 16. Barium, iron, manganese and zinc were detected at levels exceeding SCDM benchmarks. The detection limits for cadmium and lead were too high to compare results to benchmarks. The analytical results indicate contribution of contaminants from the tailings ponds to the side tributary and the Dolores River (Table 16) (Figure 9) (CDPHE 2003c).

6.6 1995 PTI DATA SUMMARY OF SURFACE WATER

In 1995 PTI summarized the available surface water and groundwater data for the Rico area. Surface water data were evaluated for the Dolores River, Silver Creek, the St. Louis settling ponds, St. Louis tunnel discharge, Santa Cruz adit, Silver Swan adit, Rico Boy adit, Jones adit, and seepage from the Argentine tailings impoundment for the years 1980-1984 and 1989-1995. Since complete documentation was not available for any one study, professional judgement was used to include only data that met EPA data quality standards (EPA 1986). These standards were not specified in the report. It was determined that data were not consistent with regard to parameters measured, detection limits, analytical methods, and sampling locations; studies were conducted by various parties and samples were analyzed by various laboratories (PTI Environmental Services (PTI) 1995).

Data that were included in the summary include 1) data collected by Gibbs and Hill, Inc. during a four week period in 1980 and 1981 and analyzed by Core Laboratories (Gibbs and Hill, Inc. 1981); 2) data collected by Steffen Robertson and Kirsten from 1982 to 1984 and analyzed by Core Laboratories to satisfy monthly sampling requirements of the Dolores River (Steffen Robertson and Kirsten (SRK)); 3) the 1985 Analytical Results for the Rico-Argentine Mine site inspection (E&E 1985); 4) Bureau of Reclamation data from 1989-1993, excluding all the mercury data except 1992 data (BOR undated); 5) data collected in 1995 by WALSH as part of the Phase II assessment (WALSH 1995); and 6) data collected by PTI in 1995 (PTI 1995). These data were used in the preparation of the draft Water Quality Assessment Report (CDPHE 2002). Although the majority

of the data are probably not of the quality required for HRS evaluation, the data support the need for additional investigation.

6.7 TOWN OF RICO MUNICIPAL DRINKING WATER

Water quality data for the town of Rico municipal drinking water are in Table 24. Samples of surface water that was diverted from Silver Creek for municipal drinking water were collected after treatment by infiltration galleries and chlorination. No inorganic Maximum Contaminant Levels (MCLs) were exceeded in the samples collected from 1992 to 2003. No VOCs or semivolatile organic compounds (SVOCs) were detected except for 0.06 ppb para-Dichlorobenzene, 2.5 ppb chloroform, and 0.59 ppb bromodichloromethane in 1999, and 2.8 ppb chloroform in 1998. Several violations were noted for turbidity and bacteria and for failure to sample (CDPHE 2003d).

6.8 ATTRIBUTION AND SURFACE WATER/SEDIMENT TARGETS

There are no municipal drinking water intakes in the 15-mile downstream target distance limit. The town of Rico obtains its drinking water from a diversion on Silver Creek above potential impacts from the Rico-Argentine mining operations (Figure 2). A new water supply system is being planned for the Dolores River upgradient of the St. Louis tunnel and Peterson Slide (EPA 2003b).

In the Dolores River rainbow trout, brown trout, brook trout, and mottled sculpin have been observed or collected (AHI 2001). Spawning habitat is limited in the study area; limiting factors to natural reproduction include heavy metal contamination as well as poor pools and cover and high water velocity (AHI 2001). In a 1992 survey, conducted by electrofishing a 1,000 foot segment on the county line downgradient of Rico, 32 rainbow trout averaging 10.5 inches, 28 brown trout averaging 5.7 inches, and 47 mottled sculpin averaging 3.5 inches were counted. Sport fishing has been documented along the Dolores River in the Rico area and fish are consumed (URS 1996; Allsup 2003). The Colorado Division of Wildlife stocks the Dolores River from the headwaters to the confluence of the West Fork of the Dolores River. In 2002 the river was stocked with 10,000 three-inch brown trout and 2,000 ten-inch rainbow trout (Colorado Division of Wildlife 2003).

Threatened and Endangered species that could potentially be impacted include the Wood Frog (Federal Endangered); the southwest willow flycatcher, Canadian lynx, and western boreal toad

(Federal Endangered); and the northern leopard frog, northern goshawk, boreal owl, tiger salamander, and Colorado River cutthroat (State Sensitive) (AHI 2003). One study of white-tailed ptarmigans conducted in the Animas River watershed documented that zinc and cadmium are accumulated by ptarmigan food plants and cadmium bioaccumulates in white-tailed ptarmigans at the rate of 0.5 micrograms (μg) per day (Larison *et al* 2000).

A survey of Silver Creek from the Rico municipal water intake to the confluence with the Dolores River (Figure 2) was performed during the URS field sampling in 1995; no wetlands or evidence of a fishery were identified during that survey; however, wetlands have since been observed (URS 1996; EPA 2003b). The flow of Silver Creek in 1995 was determined to be approximately 10 cfs (URS 1996).

Wetlands were observed during the expanded Site Inspection in the one-mile stretch along the Dolores River starting at the confluence of Silver Creek with the Dolores River and continuing downgradient. Several small wetlands (less than one acre) were noted for the first three-quarters of a mile. A larger palustrine scrub/shrub (obligate) wetland, approximately five acres in size, was documented between three-quarters of a mile and one mile downstream of the Silver Creek/Dolores River confluence (URS 1996).

A wetlands study was conducted by AHI in 2000 beginning at the north end of Rico and continuing downgradient about 1.5 miles. Although the 1987 Army Corps manual protocol was used to determine wetlands, field sheets provided in the report provide data to support categorization as wetlands under the 40 CFR 230.3 definition of wetlands required by the HRS (AHI 2001, EPA 1992b). Approximately 25 acres of wetland were identified (Figure 13) (AHI 2001).

A significant community of montane riparian forest (*Populus augustifolia*-*Picea pungens*/*Alnus incana*) can be found on the east bank of the Dolores River within four miles of the site. The natural community is ranked rare to uncommon both globally and in Colorado (Colorado Natural Heritage Program 1994).

7.0 SOIL EXPOSURE PATHWAY

Most of the town of Rico is on alluvial soil, some of Rico is located on mineralized deposits and some of Rico is located on mine waste (CDPHE 1996). Little soil sampling has been conducted in the historic part of Rico and no sampling of road materials has been conducted. Previous studies that contain soil data include: the 1995 Phase II Environmental Site Assessment, the 1996 EPA Expanded Site Inspection, the 1996 CDPHE Soil Study, and the 2003 EPA Office of Research and Development Soil Sampling.

7.1 1995 PHASE II ENVIRONMENTAL SITE ASSESSMENT

Residential soil samples were collected during the 1995 Phase II Environmental Assessment. Concentrations of lead up to 12,000 mg/kg were present within the study area where fill material, mine tailings, waste rock, and slag were visible. However, samples collected from properties that appeared to have native soil contained lead concentrations ranging from 62 mg/kg to 9,300 mg/kg with a mean of 858 mg/kg. Some properties, especially in the southeast portion of the study area, had concentrations of lead from 62 mg/kg to 260 mg/kg. Sample locations are shown in Figure 8 and analytical results are listed in Table 23. Data do not appear to have been validated and quality is unknown. In addition, the detection limit for arsenic was above the SCDM benchmark (WALSH 1995).

7.2 1996 EPA EXPANDED SITE INSPECTION

Residential soil samples were collected in 1996 from six properties within the town of Rico (Figure 4) (Table 17). The field team interviewed more than a dozen local residents, many of whom had lived in Rico for decades. No construction or fill materials were positively identified by local residents as derived from mine tailings. Samples were collected from areas on the properties that the field crew or residents believed could potentially contain fill material derived from local mine workings. The inorganic results for two of the residential soil samples, RA-SO-03 and RA-SO-05, were very close to the results for the background sample, RA-SO-01, located upgradient of the St. Louis tunnel. Elevated concentrations of copper, lead, antimony, arsenic, manganese, mercury, silver, and zinc were each found in at least two of the four samples. Cadmium, calcium, sodium, magnesium, vanadium, and cyanide were recorded at elevated concentrations in at least one other

sample as shown in Table 17. When these locations are plotted on a map, the area defined by these elevated concentrations is approximately 776,000 square feet (URS 1996).

7.3 1996 CDPHE SOIL STUDY

This 1996 study was conducted by CDPHE in collaboration with ARCO to determine whether metals detected in soils in past studies are anthropogenic or natural or a combination. Samples were sent to Analytica Environmental Laboratories, Inc. for total lead analysis using method SW-846, inductively coupled plasma (ICP) metals using method SW 6010, and acid digestion by method 3050A. In addition selected samples were analyzed using electron microscopy/metal speciation with a JOEL 8600 Electron Microprobe, clay mineralogy using X-ray diffraction, and Cation Exchange Capacity using EPA method 9081 by ARCO Exploration and Production Technology (CDPHE 1996). Analytical data do not appear to have been validated; the quality of the data is unknown.

Analytical results are listed in Table 18. Sample locations are shown in Figure 11. Sample results document that native colluvium in the Rico area contains naturally occurring lead. The source could be the weathering of the near surface mineralized bedrock, such as that found in the nearby mineralized fault. No anthropogenic sources of lead were observed in the immediate vicinity of the sample locations. The RC-3 samples document anthropogenic sources in the sample collected from 1 inch to 14 inches. RC-4 sample results, including speciation, documented that smelter activities may have contributed to detected lead levels. RC-5 samples documented that unmineralized bedrock is not a significant contributor of soil lead. RC-6 samples were collected to document lead levels present in the ancestral Silver Creek alluvial fan; however, the lead found in the fine fraction may have migrated from upgradient locations. RC-8 samples were collected to document lead concentrations from Greenstone; however, the soil sample may have been impacted by upgradient soil. RC-21 samples contained high levels of lead and since lead speciation was not conducted on that sample, the source is unknown (CDPHE 1996).

Several conclusions were reached by the investigators from the CDPHE: 1) Natural sources of the elevated lead levels are present in the Rico town area. These sources are related to the exposure of and weathering of mineralized bedrock and characteristically contain lead-bearing manganese and iron oxide phases that are produced by the oxidation and hydrolysis of original mineral assemblages. 2) Anthropogenic sources of elevated lead contents are present in the Rico town area including waste

rock, mill tailings, and smelter slag. The mining-related wastes were determined to be physically and mineralogically different from materials derived from the erosion and weathering of mineralized bedrock. 3) Impacts on soil of the sulphuric acid plant appear to be minimal. 4) The efforts to identify smelter emission products were inconclusive and would require a more extensive study. Smelter emissions may not be a significant contributor to lead in soil because of the short period of operation, the small quantities of lead processed, and the prevalence of other lead sources (CDPHE 1996).

7.4 2003 EPA OFFICE OF RESEARCH AND DEVELOPMENT SOIL SAMPLING

Surface soil sample were collected in the town of Rico in areas of residential use or planned residential use. Samples were collected in locations where XRF field screening results for the contaminants of concern, lead, zinc, mercury, and arsenic, were the highest. The purpose was to determine if further study or remediation investigation would be required prior to development (EPA 2003a). Samples were analyzed for metals by the Land Remediation and Pollution Control Division staff (ORD) laboratory. Data were not validated; however, the laboratory data package can be made available for validation. Results are listed in Table 19 and sample locations are shown in Figure 12. SCDM Cancer Risk Screening Concentration (CRSC) benchmark for arsenic was exceeded in 5 of the 10 samples. The concentrations detected may be within the average range of arsenic levels in that area (USGS 1984). The study of element concentrations in soils and other surficial materials conducted by Shacklette in the conterminous United States documented arsenic concentrations ranging from 0.1 mg/kg to 97 mg/kg with an average arsenic concentration of 7.2 mg/kg and a geometric mean concentration of 5.2 mg/kg. Lead levels ranged from 699 mg/kg to 17,402 mg/kg in 7 of the 10 samples (EPA 2003a).

7.5 ATTRIBUTION AND SOIL TARGETS

The ore bodies in the Rico town area are relatively near the surface; mine workings were not developed at great depth. The Atlantic Cable workings were dug on outcropping mineralization. The Grand View and the Pasadena smelters operated for brief periods before the turn of the 20th century. In addition, the Pro Patria and the Rico-Argentine mills operated using the floatation system resulting in two tailings ponds that were addressed in 1996 under the Colorado Voluntary Cleanup and Redevelopment Act. Several waste rock piles were visible next to former mine

workings in and around Rico. A sulfuric acid plant operated north of town (CDPHE 1996). In addition, mine waste may have been used for road base (Small 1995). All of these activities are potential sources of lead in soils. Further analytical investigation, including lead speciation, may be helpful to attribute the source of lead in soils at specific locations (Drexler 2003).

The mining sites are inactive; therefore, there are no workers on the mine sites. The site is situated within the San Juan National Forest, an area that receives high recreational use, and historic mining areas are accessible. The current population of Rico is 250 with an additional 100 summer residents and includes approximately 25 children; however, additional housing development is planned. Individual residents may live within 200 feet of soils containing levels of metals above SCDM benchmarks (URS 1994; Town of Rico 2003).

The endangered black-footed ferret and bald eagle may inhabit the area. The proposed endangered southwestern willow flycatcher and threatened Mexican spotted owl also may be found in the Rico area. The federal candidate species North American wolverine, black tern, and northern goshawk may inhabit the area (URS 1994).

8.0 GROUNDWATER PATHWAY

Groundwater samples were collected during the 1996 expanded Site Inspection by URS and during the 2003 TBA by CDPHE.

8.1 1996 EXPANDED SITE INSPECTION

No downgradient groundwater users were identified during the expanded SI. Groundwater was collected from the domestic well at the Rico ranger station northwest and upstream of the site and the town of Rico. Table 21 contains total and dissolved inorganic results for this well; Figure 4 shows the sample locations. Analytical results show detectable concentrations of barium, calcium, magnesium, manganese, potassium, sodium and zinc. The well at the Rico ranger station is downstream of some abandoned mines. It draws water from valley fill talus, landslide, and alluvial material, and is across the Dolores River (west) and topographically above the St. Louis ponds (URS 1996).

8.2 2003 TARGETED BROWNFIELDS ASSESSMENT

Eight groundwater samples were collected by CDPHE from the North Rico Light Industrial Park and five from the Maintenance Barn Site (Figure 9) and analyzed by a CLP laboratory for the dissolved fraction of arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and zinc by method SW6010B - ICP. The five samples collected at the Maintenance Barn Site were also analyzed for VOCs, PAHs, pesticides, herbicides, and DRO. Data were validated and are acceptable for use in this evaluation as qualified. The detection limit for arsenic is above a SCDM benchmark. Inorganic analytical results are in Table 22 and organic results are in Table 26. Detected concentrations of arsenic, cadmium, and manganese exceeded a SCDM benchmark in at least one sample. Detected concentrations of barium, copper, iron, manganese, and zinc were more than three times the concentration of the background sample at 11 of the 12 locations as shown in Table 22. No organic SCDM benchmarks were exceeded (CDPHE 2003c).

8.3 GROUNDWATER ATTRIBUTION AND TARGETS

In 1994 the Colorado State Engineers Office listed three wells as household use (Colorado Office of the State Engineer 1994). Two of the wells are located approximately 0.5 mile upgradient of the St. Louis tunnel. The third domestic well is at the south end of the town of Rico (URS 1996). Domestic wells located south of Rico in a housing development have not been sampled. Within the four-mile site radius, in addition to the domestic wells there is one industrial well. The site does not lie within a wellhead protection area (URS 1994).

Rico is served by a municipal drinking water system. The intake is located upgradient of the Blaine adit and the Argentine tailings on Silver Creek (Figure 2). The water is piped from that location to Rico. Contaminated groundwater may be infiltrating the municipal drinking water system at unknown locations. No organic or inorganic sampling data are available for samples collected from residential taps (CDPHE 2003d). A new water intake has been proposed to be located above Peterson Creek (Figure 2) (EPA 2003b).

9.0 GROUNDWATER TO SURFACE WATER PATHWAY

The groundwater to surface water pathway has not been evaluated and no information is available regarding the extent to which contaminants detected in limited groundwater sampling may impact surface water.

10.0 AIR PATHWAY

The air pathway has not been evaluated because there has been no indication that there is a release to the air pathway (URS 1996). No air sampling data are available. If it is determined that mine waste rock has been used as road base, dust from the unpaved streets may be a source for the air pathway with a target population of about 250 residents. Some waste rock and tailings piles and abandoned tailings ponds are exposed, which would be a threat to the air pathway if future development occurs near these sites.

11.0 SUMMARY

The Rico-Argentine site is an inactive mining and milling operation in Dolores County and the Rico Mountains of southwestern Colorado located in two drainages, the Dolores River and its tributary Silver Creek. The major site operations consisted, first, of precious metal mining; second, of base metal production (lead, zinc, and copper) from sulfide ores; and finally, of sulfuric acid production from pyrite ores. Mining activities occurred on and near the Rico-Argentine site approximately from 1860 until 1971.

Many investigations and sampling efforts have occurred in the area in the last twenty years. Cleanup and stabilization activities as well as water treatment have also been conducted at the site. All of this information and sampling data have been reviewed to evaluate surface water, groundwater, soil exposure, and air pathways, and associated targets to determine if the Rico Argentine site potentially impacts the environment or human health. Very limited data exist that meet data quality requirements for HRS evaluation. Sample locations can not be consolidated on a single map because GPS or other specific descriptive location information is not consistent. Data quality issues include non-comparable, inconsistent or unknown analytical methods and variable field sampling techniques, field analytical methods with inadequate laboratory confirmation, inadequate field quality control, lack of data validation, sample quantitation limits and detection limits undocumented, detection limits too high for comparison to SCDM benchmarks, data qualified by validator because of laboratory quality control issues, lack of background samples for the sampling event, monthly average concentrations reported, and the use of composite samples.

It is estimated that approximately 400,000 tons of waste material is at the site. Various waste piles have been sampled; however, waste quantities by exact location are not available. Waste characterization data is required for HRS evaluation including specific source area, located with a GPS, as well as calculated waste quantities and validated analytical results for samples collected at each source location. Source samples collected from various waste piles and settling pond sediment document the presence of arsenic (137 J mg/kg), cadmium (227 mg/kg), chromium (13.5 mg/kg), lead (17,402 mg/kg), mercury (0.48 mg/kg), zinc (43,900 J mg/kg), and cyanide (5.4 mg/kg).

The air pathway has not been evaluated because there has been no indication that there is a release to the air pathway. No air sampling data are available. If it is determined that mine waste rock has been used as road base, dust from the unpaved streets may be a source for the air pathway with a target population of about 250

residents. Some waste rock and tailings piles and abandoned tailings ponds are exposed, which would be a threat to the air pathway if future development occurs near these sites.

Since Rico is served by a municipal system with the surface water intake located upgradient of most mine workings, the groundwater pathway is not considered a significant concern at this time; however, all known drinking water wells in and around Rico should be sampled to ensure water meets drinking water standards. Groundwater collected from monitoring wells documented concentrations of arsenic, cadmium, and manganese above SCDM benchmarks. No data are available regarding the possibility that potentially contaminated groundwater may be infiltrating the drinking water system.

For purposes of conducting a Water Quality Assessment, CDPHE identified the St. Louis tunnel/St. Louis ponds, the Blaine adit, the Argentine tailings seep, the Columbia tailings, and the Rico Boy, Santa Cruz, and Silver Swan adits as sources of metals contamination in surface water. Other source areas has been identified during a number of site inspections. Outfall 002 has been in violation of the CDPS permit repeatedly. Adit and seep discharge samples in addition to surface water and sediment samples document releases of metals including cadmium (1,490 $\mu\text{g/L}$), lead (172 $\mu\text{g/L}$), mercury (0.8), and zinc (176,000 $\mu\text{g/L}$) in water and arsenic 52.6 J mg/kg, cadmium (17.8 mg/kg), lead (12,000 mg/kg), zinc (48,300 mg/kg), and cyanide (2.2 mg/kg) in sediment samples collected from Silver Creek and the Dolores River. The Dolores River is a documented fishery; fish are consumed. A fish tissue study conducted in the McPhee Reservoir, downgradient of the site beyond the 15-mile target distance limit, documented mercury concentrations that exceeded the SCDM food chain RDSC of 0.41 ppm. The surface water pathway is of primary concern. Although a large body of sampling data exist, most of the data would not meet the data quality requirements for HRS evaluation for various reasons and cannot be used. Data indicate that the Dolores River is significantly impacted by contamination that can be attributed to the mining sites. Data suitable for HRS evaluation are required.

The surface soil pathway is a concern for public health and will be an increasing concern as development plans for the area are implemented. Analytical results for soil samples document lead levels that are significantly above levels that are protective of human health (2,620 mg/kg in one residential yard). In addition, mine waste piles in residential areas are accessible. The source of lead in soils appears to be anthropogenic in some areas, natural in some areas, and a combination in other areas. Speciation of lead samples may be helpful for determining attribution. In addition, a human health risk assessment of lead may be appropriate, regardless of source and attribution. Data suitable for HRS evaluation are required.

12.0 LIST OF REFERENCES

Allsup, Ernest. 2003. Personal communication of UOS Bev Halwa with Ernest Allsup, owner of the Priest Gulch Campground and RV Park, regarding his consumption of fish he caught in the Dolores River. September 3, 2003.

Anaconda Minerals Company (Anaconda). 1988. Letter from Robert Dent, Anaconda Minerals Environmental Manager, to James B. Horn, Colorado Department of Health Water Quality Control Division District Engineer. August 28, 1988.

Anaconda Minerals Company (Anaconda). 1994. Personal communication of Barry Hayhurst of URS with Bob Dent, Minerals Environmental Manager. May 20, 1994.

Anderson Engineering Company, Inc. (Anderson). 1997. Rico Mining Area Construction Completion Report Argentine Tailings, Columbia Tailings, Santa Cruz Mine, Silver Swan Mine, Grand View Smelter Prepared for Atlantic Richfield Company. January 1997.

Aqua-Hab, Inc. (AHI). 2001. Report of Biological & Aquatic Surveys Along the Dolores River Corridor at Rico. January 2001.

Atlantic Richfield Company (ARCO). 2001. Letter from Chuck Stilwell, P. E. ARCO Environmental Remediation LLC to Susan Nachtrieb, CDPHE regarding Rico Mine Dolores River Water Quality Assessment. February 8, 2001.

Atlantic Richfield Company (ARCO). 2002. Letter from Chuck Stilwell, P. E. ARCO Environmental Remediation LLC to Susan Nachtrieb, CDPHE regarding Comments on the Draft Water Quality Assessment for the St. Louis Ponds. August 12, 2002.

Camp Dresser & McKee (CDM). 1992. Toxicity Test Results Rico Development Corporation NPDES No. CO0029793. December 30, 1992.

Camp Dresser & McKee (CDM). 1993a. Toxicity Test Results Rico Development Corporation NPDES No. CO0029793. April 7, 1993.

Camp Dresser & McKee (CDM). 1993b. Toxicity Test Results Rico Development Corporation NPDES No. CO0029793. September 3, 1993.

Camp Dresser & McKee (CDM). 1993c. Toxicity Test Results Rico Development Corporation NPDES No. CO0029793. December 28, 1993.

Citizens For Accountability and Responsibility (CFAR). 2002. Water Quality Study: Dolores River 2002.

Colorado Department of Natural Resources, Bureau of Mines (BOM). 1939a. Inspectors Report prepared by District No. 4 State Mine Inspector, D. C. McNaughton. April 15, 1939.

Colorado Department of Natural Resources, Bureau of Mines (BOM). 1939b. Report to Bureau of Mines. March 18, 1939.

Colorado Department of Natural Resources, Bureau of Mines (BOM). 1971. Information Report by District No. 4 Inspector. June 10, 1971.

Colorado Department of Natural Resources, Bureau of Mines (BOM). 1974. Information Report by District No. 4 Metal Mining Inspector, Thomas D. High. December 5, 1974.

Colorado Department of Natural Resources, Bureau of Mines (BOM). 1975. Information Report by District No. 4 Metal Mining Inspector Thomas D. High. July 17, 1975.

Colorado Department of Natural Resources, Division of Minerals and Geology. (2003). Mine Permit Database and Mineral Prospecting Database; search conducted by Harry H. Posey, Ph.D. Geologist. November 7, 2003.

Colorado Department of Public Health and the Environment (CDPHE). 1993. (Formerly the Colorado Department of Health.) Water Quality Control Division. Authorization to Discharge Under the Colorado Discharge Permit System. Permit No. CO-0029793. December 30, 1993.

Colorado Department of Public Health and the Environment (CDPHE). 1995. Water Quality Control Division. Letter from CDPHE Patricia Nelson, P.E., to David Sell, Rico Development Corporation,

regarding the Delinquent Discharge Monitoring Report(s) Permit No. CO-0029793 Dolores County. February 10, 1995.

Colorado Department of Public Health and the Environment (CDPHE). 1996. Hazardous Materials and Waste Management Division. Soils Study Rico, Colorado. Mark Walker. August 01, 1996.

Colorado Department of Public Health and the Environment (CDPHE). 2002a. Permits Unit. Letter from CDPHE Susan Nachtrieb to ARCO Chuck Stilwell regarding Water Quality Assessment (WQA) for the Rico-Argentine Mine Site. January 14, 2002.

Colorado Department of Public Health and the Environment (CDPHE). 2002b. Water Quality Control Division. Rico-Argentine Mine Area Water Quality Assessment. January 14, 2002.

Colorado Department of Public Health and the Environment (CDPHE). 2003a. Permits Unit. Letter from CDPHE Susan Robinette to ARCO Chuck Stilwell regarding August 12, 2002, Comments on the draft Water Quality Assessment (WQA) for the Rico-Argentine Mine Site. April 4, 2003.

Colorado Department of Public Health and the Environment (CDPHE). 2003b. Permits Unit. Personal conversation: CDPHE Susan Robinette to URS Bev Halwa regarding Rico Argentine site. August 29, 2003.

Colorado Department of Public Health and the Environment (CDPHE). 2003c. Hazardous Materials and Waste Management Division. Targeted Brownfields Assessment Analytical Results Report, North Rico Light Industrial Park and County Maintenance Barn Sites. Rico, Colorado. April 22, 2003.

Colorado Department of Public Health and the Environment (CDPHE). 2003d. Water Quality Division - Compliance Assurance and Data Management Unit. Water Quality Data for ID 117700 - Town of Rico. October 29, 2003.

Colorado Division of Wildlife. 2003. Personal communication of Bev Halwa of UOS with Durango Office Aquatic Biologist Mike Japhet regarding the Dolores River fishery. September 2, 2003.

Colorado Natural Heritage Program. 1994. State species of concern listing prepared by Katherine E. Pague, Information Manager. April 25, 1994.

Colorado Office of the State Engineer. 1994. Colorado Wells, Applications, and Permits and Water Rights Report. April 6, 1994.

Drexler, John. 2003. Telephone conversation of Bev Halwa with John Drexler, The Laboratory for Environmental and Geological Studies (LEGS), Department of Geological Sciences, University of Colorado, regarding lead speciation. November 6, 2003.

Dunne, Thomas and Luna B. Leopold. 1978. "Water in Environmental Planning." W. H. Freeman and Company, San Francisco.

Ecology and Environment, Inc. (E&E). 1984. Potential Hazard Waste Site - Site Inspection Report, Form 2070-13. Prepared by Margaret Babits, EPA Field Investigation Team. November 14, 1984.

Ecology and Environment, Inc. (E&E). 1985. Analytical Results for Rico-Argentine Mine, Rico, Colorado. Prepared by Meg Babits. July 29, 1985.

Ecology and Environment, Inc. (E&E). 1991. Preliminary Assessment McPhee Reservoir Montezuma County, Colorado TDD F08-9106-08 - Pan FCO0304PAA. September 12, 1991.

ESA Consultants, Inc. (ESA). 1995. Rico Mining Area Summary of Environmental Data. Prepared for Atlantic Richfield Company. April 27, 1995.

ESA Consultants, Inc. (ESA). 2000. Upper Dolores River and Silver Creek Basin Water Quality and Discharge Monitoring Summary, Rico, Colorado. September 18, 2000 (prepared for ARCO).

Gibbs and Hill, Inc. 1981. Anaconda Copper Company, Rico Project, Final Report. December 1981.

J. E. Reynolds & Associates. 2000. Letter from J. E. Reynolds to Joshua Epel of Gabelhouse & Epel regarding Rico Development Corp Civil Action 99-M-1386 St. Louis Tunnel Wastewater Treatment System. February 7, 2000.

Larison, James R., Gene E. Likens, John W. Fitzpatrick and J. G. Crock. 2000. Cadmium toxicity among wildlife in the Colorado Rocky Mountains. Nature magazine. July 13, 2000.

National Climatic Data Center (NCDC). 2003. NCDC On-Line Monthly Precipitation Data for the National Weather Service station in Rico, Colorado. <http://www.ncdc.noaa.gov/oa/climate/online/coop-precip.html>

Office of the Federal Register. 1990. National Archives and Records Administration. December 14, 1990. Code of Federal Regulations (CFR) 40, Part 300, "Hazard Ranking System (HRS) for Uncontrolled Hazardous Substances Releases." Appendix A of the National Oil and Hazardous Substances Release Contingency Plan.

PTI Environmental Services (PTI). 1995. Summary of Surface Water and Groundwater Data for Rico, Colorado. Prepared for Atlantic Richfield Company and ESA Consultants, Inc. November 1995.

Short Elliott Hendrickson, Inc. (Short). 2002a. Upper Dolores River and Silver Creek Basin Water Quality and Discharge Monitoring Summary, Rico, Colorado. July 2002 Sampling Event. December 23, 2002.

Short Elliott Hendrickson, Inc. (Short). 2002b. Upper Dolores River and Silver Creek Basin Water Quality and Discharge Monitoring Summary, Rico, Colorado. October 2002 Sampling Event. December 23, 2002.

Short Elliott Hendrickson, Inc. (Short). 2003. Amendment No. 1 to Dolores River and Silver Creek Basin Water Quality and Discharge Monitoring Summary, Rico, Colorado, October 2002 Sampling Event. March 11, 2003.

Small, Bob. 1995. Personal communication of Barry Hayhurst, UOS, with Bob Small, Mayor of Rico. May 16, 1995.

Steffen Robertson and Kirsten (SRK). 1984. Monthly Sampling of Dolores River from 1982 to 1984.

Town of Rico. 2003. Personal Communication of Bev Halwa of UOS with Rico City Manager, Eric James Hill, Esq. regarding population and wetlands. September 2, 2003

U.S. Department of the Interior, Bureau of Reclamation (BOR). Undated. Dolores River Basin Water Quality Study 1989-1993.

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846. 1986.

U.S. Environmental Protection Agency (EPA). 1992a. Guidance for Performing Site Inspections Under CERCLA. Interim Final.

U.S. Environmental Protection Agency (EPA). 1992b. Hazard Ranking System Guidance Manual.

U.S. Environmental Protection Agency (EPA). 1993a. Record of Communication by EPA Site Assessment Manager Pat Smith and Durango Bureau of Reclamation Stan Powers. December 3, 1993.

U.S. Environmental Protection Agency (EPA). 1993b. "Region VIII Supplement to Guidance for Performing Site Inspections Under CERCLA." January 1993.

U.S. Environmental Protection Agency (EPA). 1996. Superfund Chemical Data Matrix. June 1996

U.S. Environmental Protection Agency (EPA). 1998a. EPA Region VIII Inspection Report, Rico Mine. June 23, 1998.

U.S. Environmental Protection Agency (EPA). 1998b. Letter from Carol Rushin, Assistant Regional Administrator of the EPA Office of Enforcement, Compliance, and Environmental Justice to David Holm Water Quality Control Division, CDPHE, regarding Notice of Violation Discharge in Violation of a Permit CDPS Permit No. CO-0029793 Section 301(a) Clean Water Act (33. U.S.C. section 1251 *et seq.* June 19, 1998.

U.S. Environmental Protection Agency (EPA). 1998c. EPA Region VIII Sampling and Analysis Plan for Compliance Inspection at Rico Development Corporation During the Week of June 22, 1998. May 13, 1998.

U.S. Environmental Protection Agency (EPA). 2000a. Action Memorandum Request for a Classic Emergency Removal Action at the Rico Town Pond (aka Rico-Argentine) Site, located north of the town of Rico, Dolores County, Colorado. June 22, 2000.

U.S. Environmental Protection Agency (EPA). 2000b. Letter to Mark Walker, CDPHE, from Dale Vodehnal, Director Superfund Remedial Response Program regarding Completion of Voluntary Cleanup for part of CERCLIS site COD9870952519, Rico-Argentine, in Rico, Colorado. April 28, 2000.

U.S. Environmental Protection Agency (EPA). 2000c. Letter to William J. Duffy, Esq, Davis, Graham & Stubbs from Sheldon Muller EPA Enforcement Attorney regarding Rico-Argentine Mine Site. June 28, 2000.

U.S. Environmental Protection Agency (EPA). 2003a. Office of Research and Development National Risk Management Research Laboratory Engineering Technical Support Center. 2003a. Samples and Corresponding Analysis, Summary Tables, Rico, Colorado. July 2003.

U.S. Environmental Protection Agency (EPA). 2003b. Personal communications of EPA Mining Team Leader Carol Russell and Bev Halwa of URS regarding Rico-Argentine. June 2003.

U.S. Environmental Protection Agency (EPA). 2003c. E-mail from EPA Enforcement Attorney Sheldon Muller to URS Bev Halwa regarding Table 1 CDPS Permit violations submitted as an attachment to the judicial complaint. June 3, 2003.

U.S. Geological Survey (USGS). 1960. 7.5-Minute Series Topographic Quadrangle, Rico, Colorado. (Photo Inspected 1975).

U.S. Geological Survey (USGS). 1970. Professional Paper 713, "Mercury in the Environment".

U.S. Geological Survey (USGS). 1974. Professional Paper 723 "Geology and Ore Deposits of the Rico District, Colorado," by Edwin T. McKnight.

U.S. Geological Survey (USGS). 1976. Dolores County, Colorado - County Map Series (Topographic).

U.S. Geological Survey (USGS). 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. Professional Paper 1270. 1984.

U.S. Geological Survey (USGS). 1987. Water Supply Paper 2220 "Basic Ground-Water Hydrology" by Ralph C. Heath.

U.S. Geological Survey (USGS). 1993. Water Data Report CO-93-2, "Water Resources Data, Colorado Water Year 1993, Volume 2, Colorado River Basin."

U.S. Geological Survey (USGS). 1994. Water Data Report CO-94-2, "Water Resources Data, Colorado Water Year 1994, Volume 2, Colorado River Basin."

U.S. Geological Survey (USGS). 2003. Daily Streamflow for Colorado USGS 09165000 Dolores River Below Rico, Co. [Http://nwis.waterdata.usgs.gov/co/nwis/](http://nwis.waterdata.usgs.gov/co/nwis/). November 4, 2003.

University of Delaware, Center for Climate Research, Department of Geography (UD). 1986. Terrestrial Water Budget Data Archive; Version 1.01, compiled by C. J. Willmott and C. M. Rowe.

URS Consultants, Inc. (URS) 1994. Site Inspection Prioritization, Rico-Argentine, Rico, Colorado. October 11, 1994.

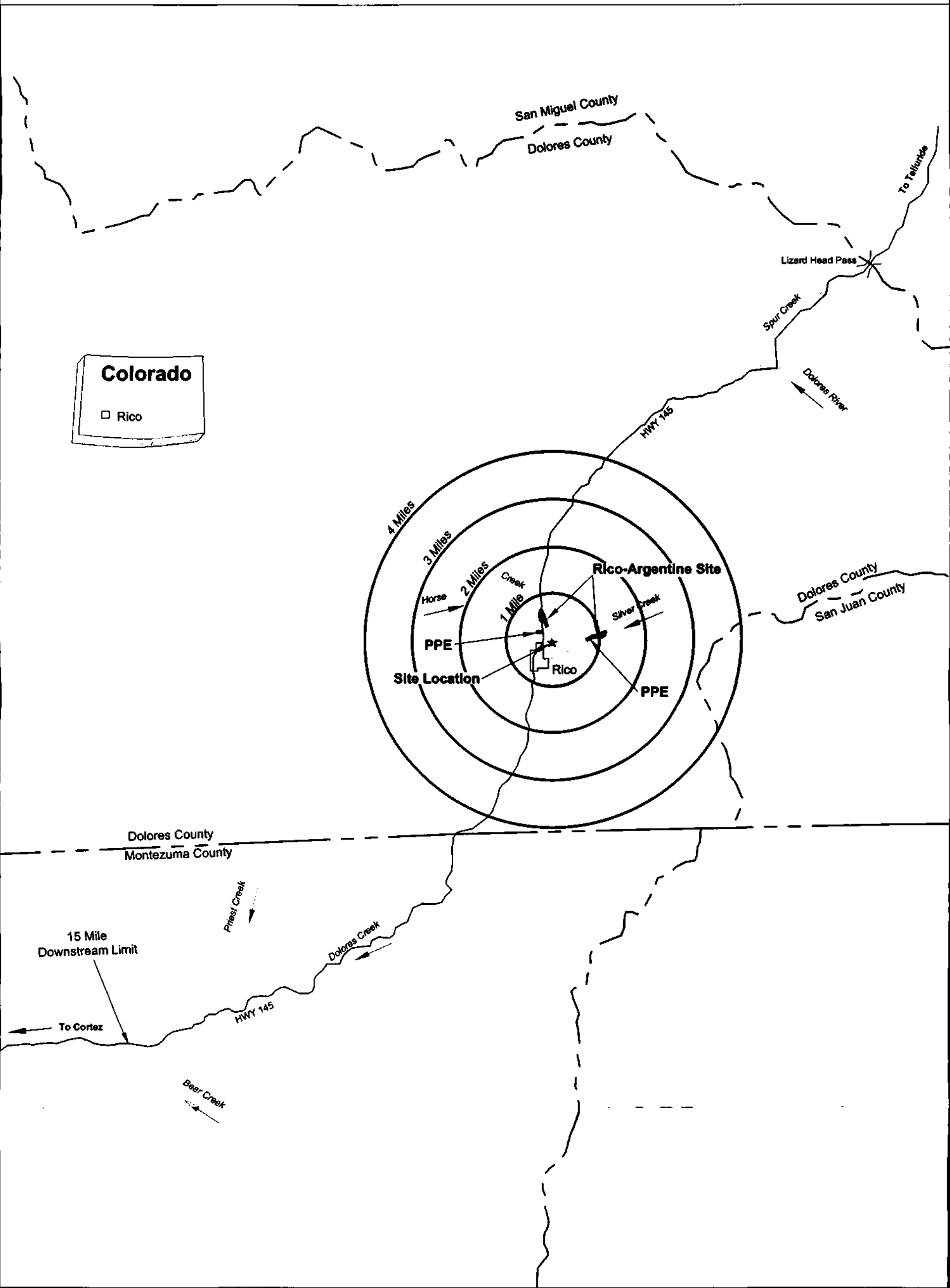
URS Consultants, Inc. (URS) 1996. Analytical Results Report, Rico-Argentine, Dolores County, Colorado. June 19, 1996.

URS Operating Services, Inc. (UOS). 2000. Emergency Response Trip Report Rico Town Pond Site, Rico, Dolores County, Colorado. May 5, 2000.

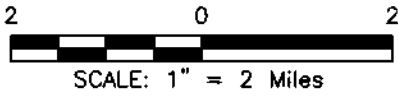
Walsh Environmental Scientists and Engineers, Inc. (WALSH). 1995. Phase I and PHASE II Environmental Site Assessment, Rico, Colorado. March 14, 1995.

URS Operating Services
START2, EPA Region VIII
Contract No. 68-W-00-118

Rico
Revision: 0
Date: 11/2003



Source: USGS 30x60 Minute Topographic Quadrangle:
1:100,000 scale, Dove Creek, 1982



Site Reassessment
TDD No. 0305-0014

Rico
Dolores County, Colorado
Area of Influence Map
Figure 1

November 2003

URS
OPERATING SERVICES

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Proposed Rico
Drinking Water IntakeFlow
Direction
D-O-L-O-R-E-SRico
Ranger StationDolores
River

Pond 18

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Pond 14

Pond 13

Pond 12

Pond 11

Pond 10

Pond 9

Pond 8

Pond 7

Pond 6

Pond 5

Pond 4

Pond 3

Pond 2

Pond 1

St Louis Ponds
Outfall 002Nora Lily
Mine

Rico

Columbia Tailings

Rico Boy Adit

Santa Cruz Adit

Silver Swan Adit

Enterprise
MineLexington
MineSilver Swan
MineMogah
MineMin Spring
MineWater
Tank

BM 8843

Sage
Hill

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Pond 286

Color Chart(s)

The following pages
contain color that does
not appear in the
scanned images.

To view the actual images, please
contact the Superfund Records
Center at (303) 312-6473.

Field Sampling Results (Parts Per Million) - XRF Method

Randomly generated property identification #	Property Address	Depth Sample 1	Depth Sample 2	Surface Sample 1	Surface Sample 2	Surface Sample 3	Surface Sample 4	Lab Confirm Performed?	Average of Surface Samples	Rank per Average Surface Sample
31	1 E Soda Street	9200		300	18000	2300		yes	6867	1
48	101 N Hancock Street	2900		5000	2400			yes	3700	2
64	18 S Argentine Street	2700		1200	4100			yes	2850	3
15	113 N Silver Street	1800		2700	2300				2500	4
16	115 N Silver Street	270		1900	2400				2150	5
12	12 Short Street	1200		2200	2000			yes	2100	6
24	102 N Garfield Street	2600		1200	2300				1750	7
44	16 Yellowman Street	1500		1500	1400				1450	8
19	5 Short Street	460		1100	1700			yes	1400	9
18	24 Hinckley Drive	870		1300	1500				1400	10
25	129 N Garfield Street	1400		850	1900				1375	11
3	8 Short Street	450		1300	1400				1350	12
17	131 Garfield Street	1000		1300	1300			yes	1300	13
9	24 S Garfield Street	960	43	2200	390				1295	14
45	33 Hancock Street	3000		2400	82				1241	15
27	34 River Street	610		1300	1300	850		yes	1150	16
4	3 E Soda Street	1800		550	1200			yes	875	17
30	214 E Mantz Avenue	520		710	1000				855	18
37	125 N Garfield Street	520		670	1100	700			823	19
11	? Commercial Street	450		850	790				820	20
22	? Argentine Street	510		920	510			yes	715	21
6	14 S Commercial Street	1500		550	850				700	22
13	226 S Argentine Street	82	1400	760	640	670			690	23
20	1 Campbell Street	370		770	610				690	24
34	12 S Argentine Street	280		390	970				680	25
33	6 Soda Street	520		680	670			yes	675	26
7	12 S Commercial Street	550		740	580				660	27
39	12 N Glasgow Street	240	3100	1100	110	760		yes	657	28
8	227 S Argentine Street	1700		700	570			yes	635	29
32	23 Garfield Street	500		170	230	1500		yes	633	30
51	219 Commercial Street	240		360	820			yes	590	31
40	32 N River Street	820		1000	570	150			573	32
48	11 S Commercial Street	510		560	490				525	33
29	13 N Argentine Street	790		830	180				505	34
26	103 N Garfield Street	530		630	300			yes	465	35
2	23 S Commercial Street	1000		790	1000			yes	434	36
21	3 Campbell Street	490		710	490	82			427	37
41	124 N Hancock Street	82		230	620			yes	425	38
23	School Playground/Park	1500		570	820	82	82	yes	389	39
43	3 S Picker Street	38		170	600			yes	385	40
10	3 King Street	220		300	450				375	41
36	213 S Commercial Street	180		210	520	340		yes	357	42
1	223 N. River Street	200		330	260	340		yes	310	43
52	4 Picker Street	160		160	400				280	44
53	Lot 38 Atlantic Cables	240		38	460				249	45
5	217 Commercial Street	500		350	130				240	46
47	12 W Eder Street	730		120	300				210	47
14	Lot 2 Silverglance Way	82		330	82				208	48
49	423 S Silverglance Way	86		260	230	82			191	49
36	333 S Silverglance Way	82		210	170				190	50
38	203 S Silver Street	84		290	78				184	51
42	195 Piedmont Street	89		63	150				107	52
60	10036 Highway 145	43		85	47			yes	66	53
28	1 Sundial Way	38		38	44	38	38	yes	40	54

 Average or Any Individual Sample of >3000 ppm lead
 Yellow Average or Any Individual Sample between 400 and 3000 ppm lead
 Green Laboratory Analysis Performed

Field Sample Analyzed by Laboratory

Randomly generated property identification #	Property Address	Depth Sample 1	Depth Sample 2	Surface Sample 1	Surface Sample 2	Surface Sample 3	Laboratory Result
1b	223 N. River Street	200					240
2b	23 S Commercial Street				1000		760
4b	3 E Soda Street			550			440
8b	227 S Argentine Street	1700					2700
12b	12 Short Street			2200			2000
17b	131 Garfield Street				1300		1400
19b	5 Short Street	460					550
22b	? Argentine Street				510		440
23b	School Playground/Park	1500					2300
26b	103 N Garfield Street				300		610
27b	34 River Street					850	700
28b	1 Sundial Way	38					15
31b	1 E Soda Street	9200					7400
31c	1 E Soda Street				18000		41000
32b	23 Garfield Street				230		310
33b	6 Soda Street	520					450
35b	213 S Commercial Street				520		410
39b	12 N Glasgow Street					760	510
41b	124 N Hancock Street				620		580
43b	3 S Picker Street	38					99
46b	101 N Hancock Street			5000			5400
50b	10036 Highway 145	43					52
51b	219 Commercial Street				820		600
54b	18 S Argentine Street	2700					4400

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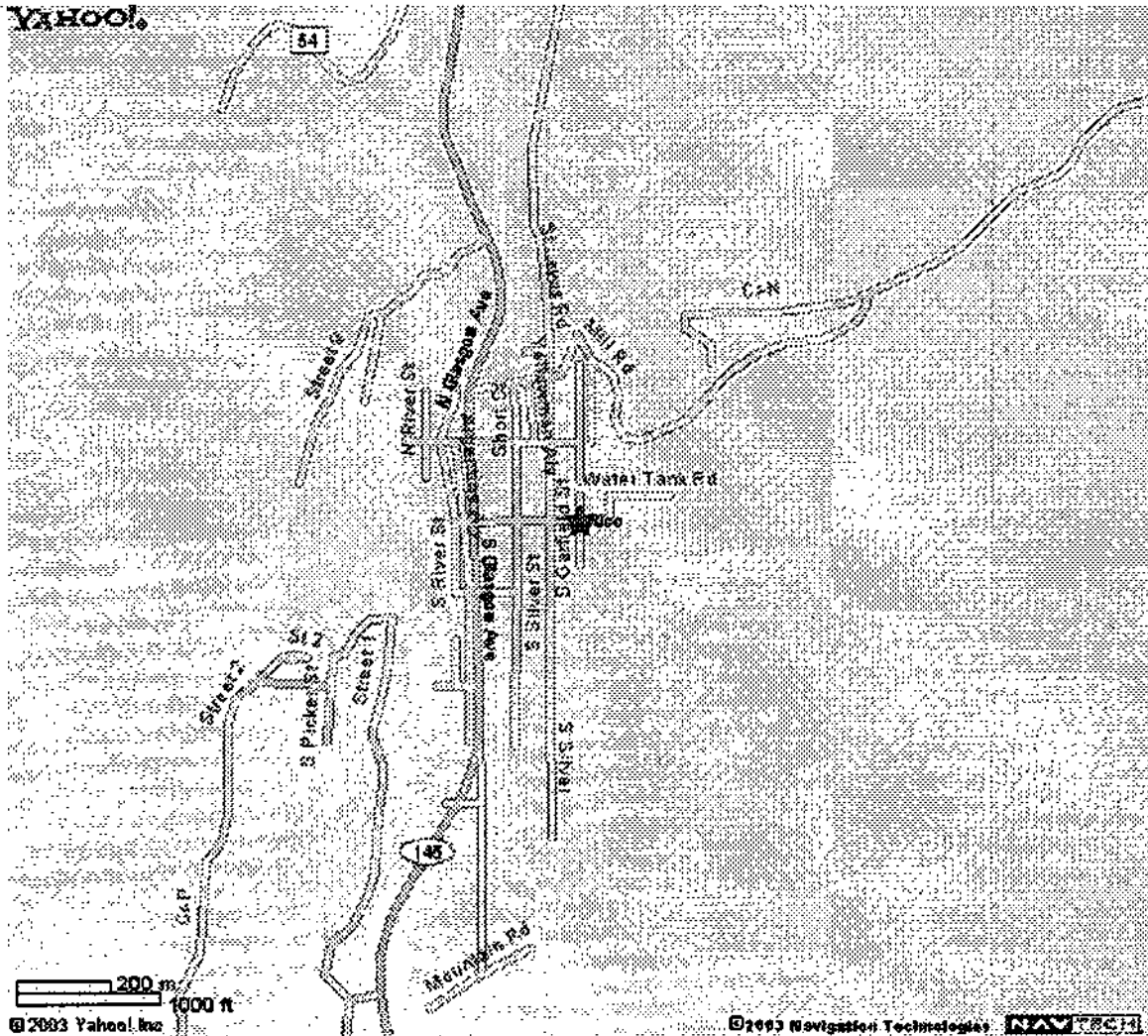
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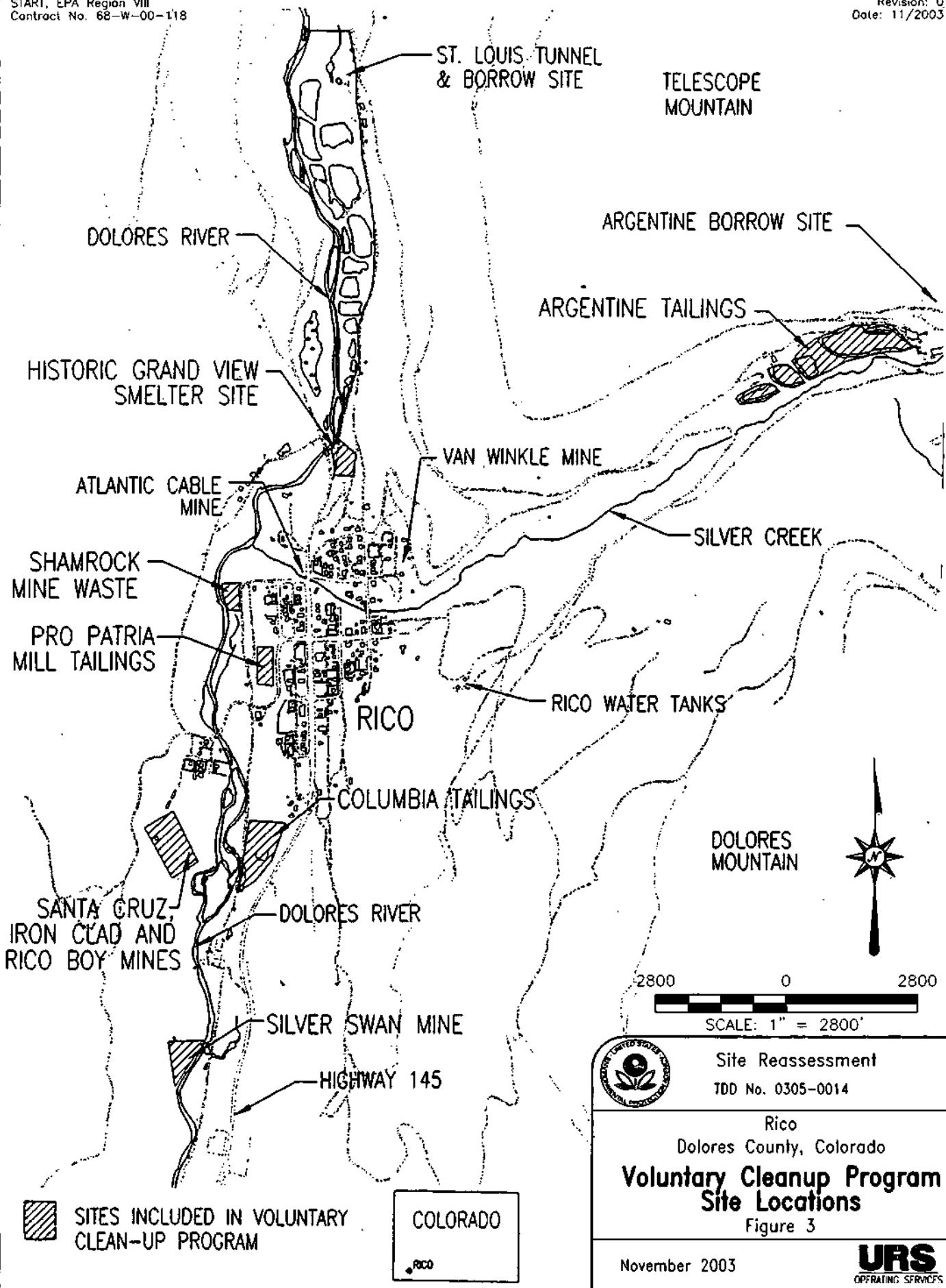
★ Rico, CO



When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

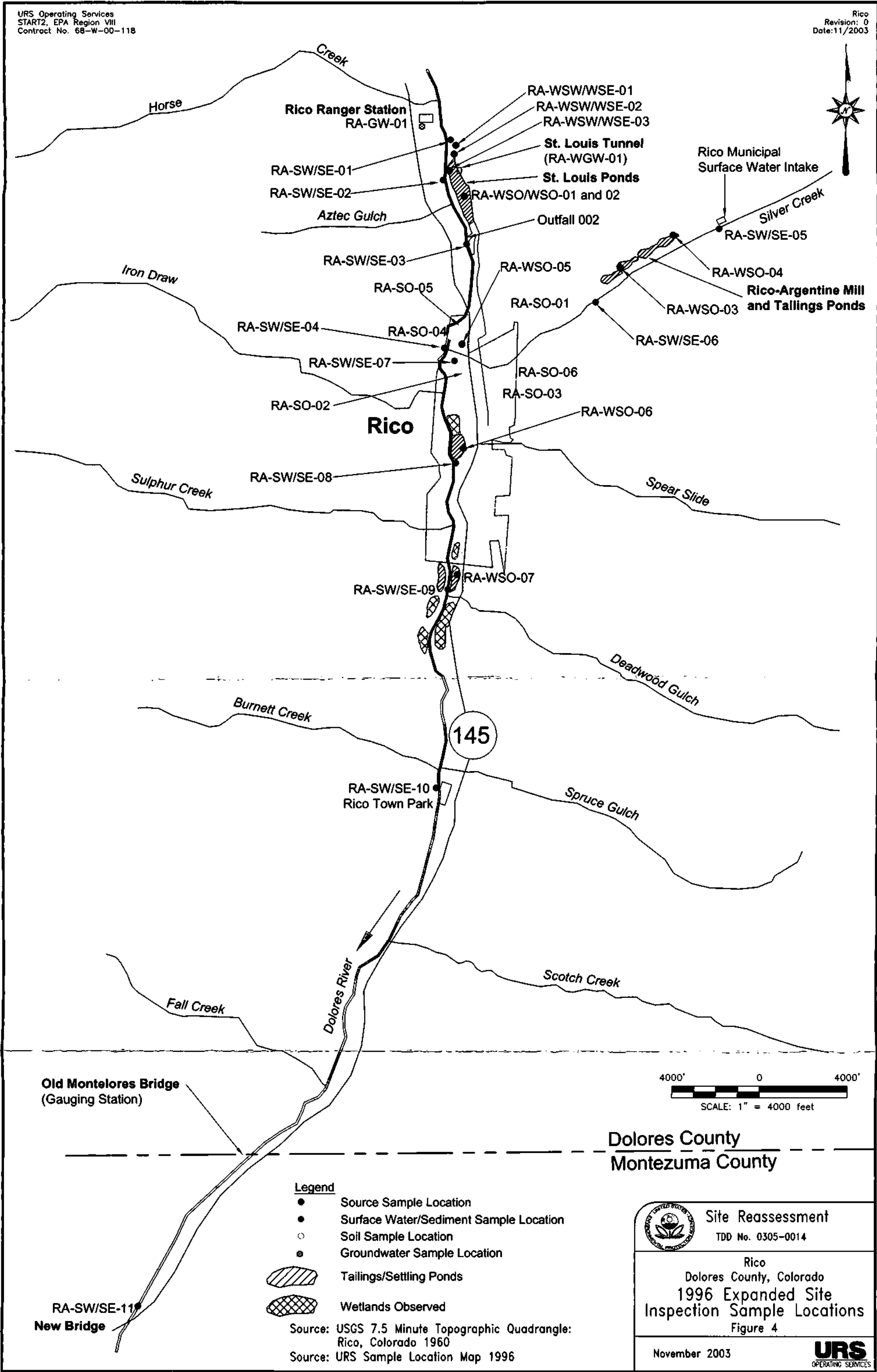
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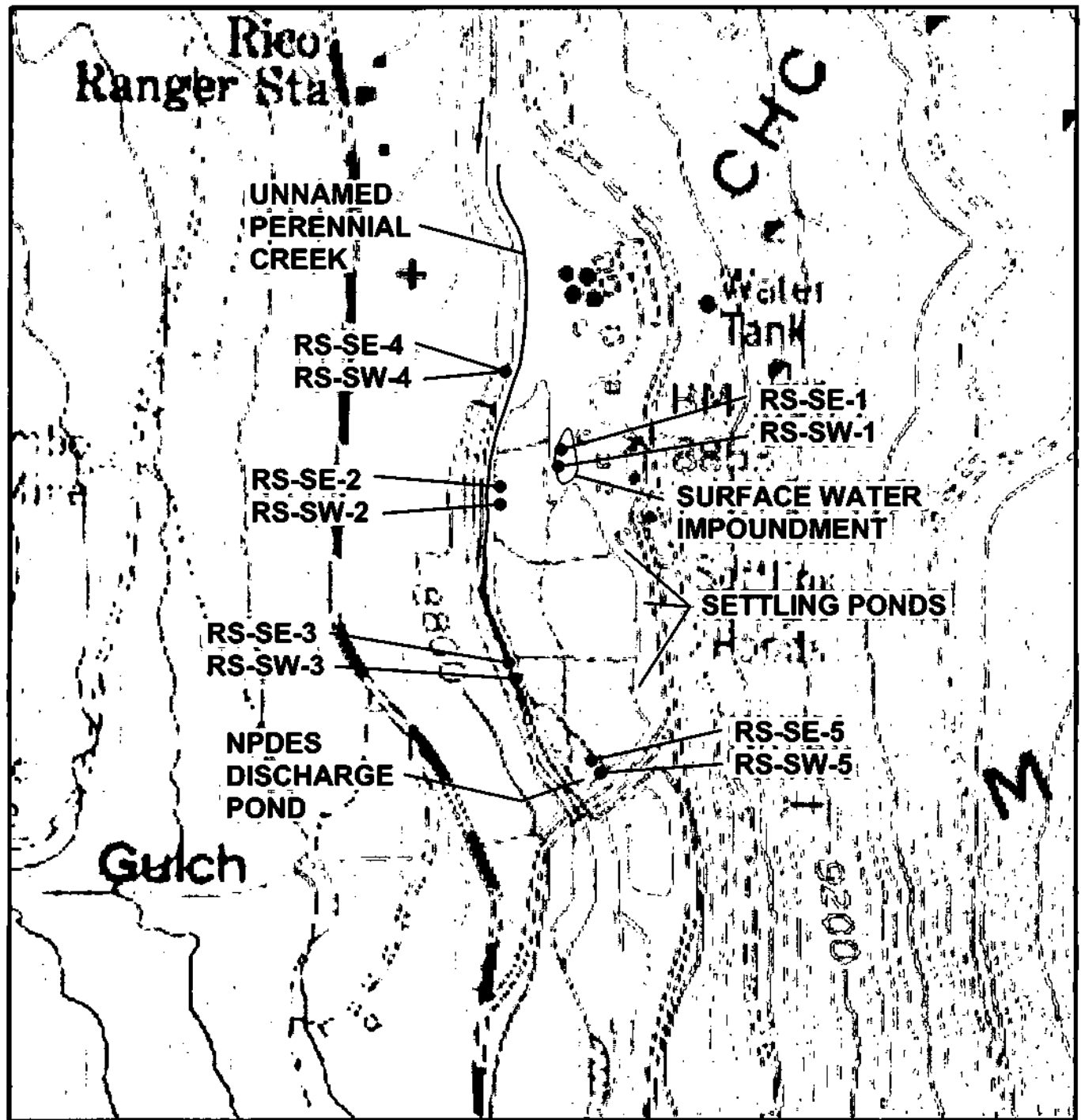
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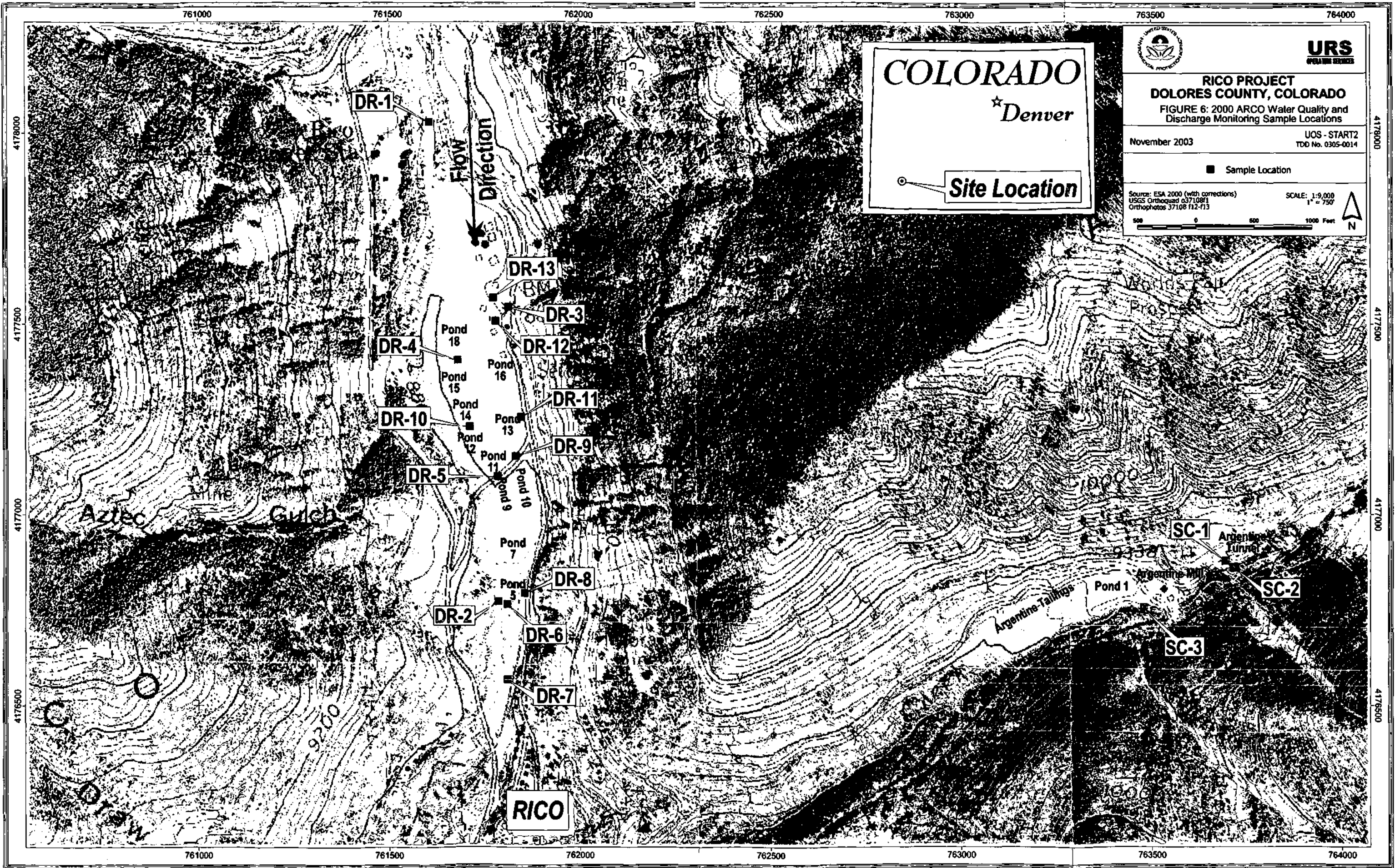


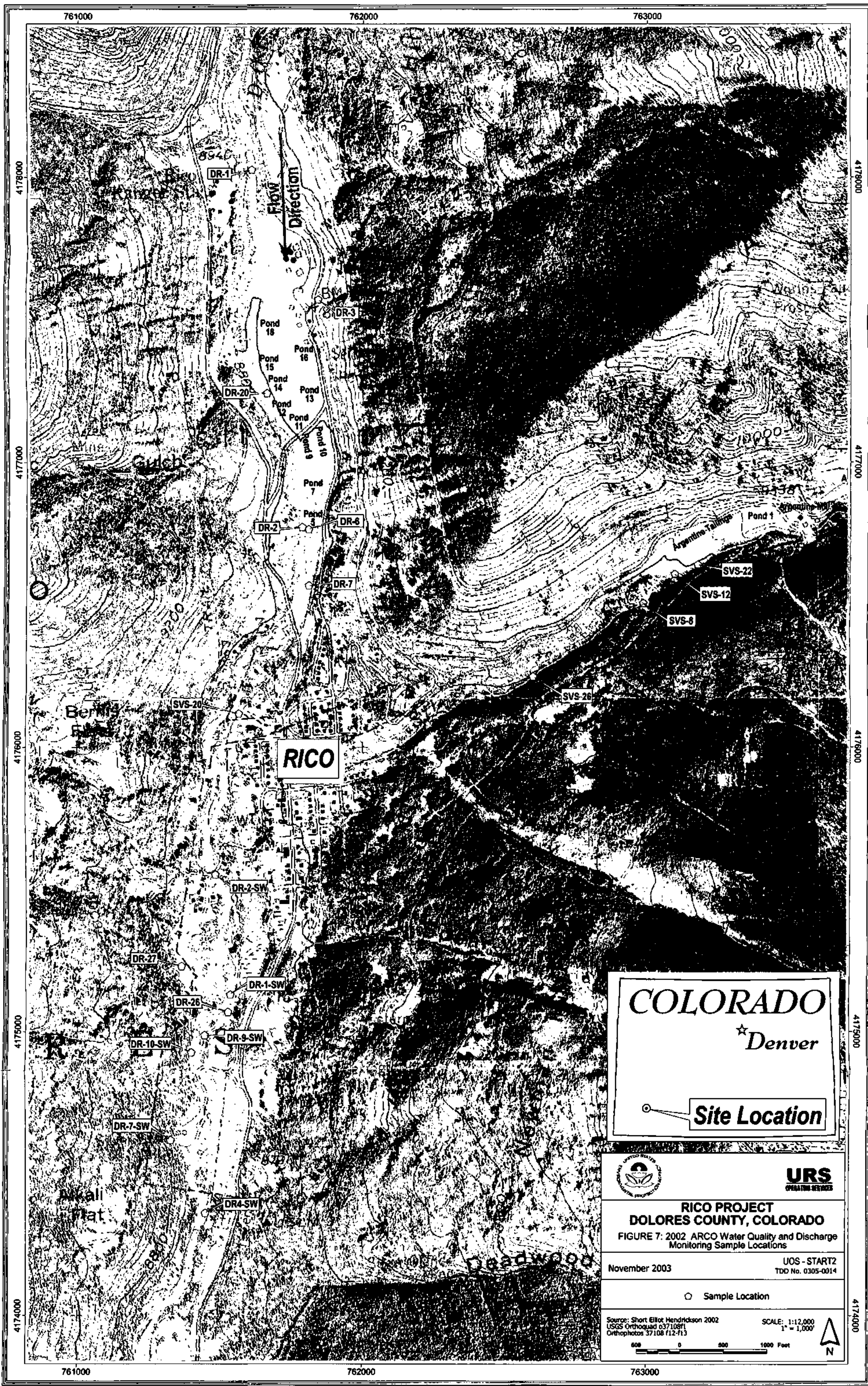
URS Operating Services
START2, EPA Region VIII
Contract No. 68-W-00-118

Rico
Revision: 0
Date: 11/2003










COLORADO

★ Denver


**Site Location**

**URS**
OPERATION SERVICES

RICO PROJECT
DOLORES COUNTY, COLORADO
FIGURE 7: 2002 ARCO Water Quality and Discharge
Monitoring Sample Locations


November 2003


UOS - START2
TDD No. 0305-0014

 Sample Location

Source: Short Elliot Hendrickson 2002
USGS Orthoquad 637108F1
Orthophotos 37108 F12-F13

SCALE: 1:12,000
1" = 1,000'


N



Phase I and Phase II Environmental Site Assessment, Rico Colorado

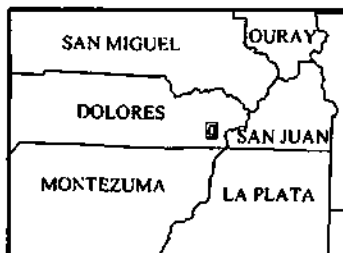
Walsh Environmental Scientists and Engineers, Inc.

- Soil sample location
- Water sample location
- * Labels depict station IDs.

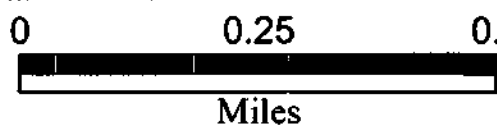
Data sources:
Base: 1:24000 USGS DOQQ
Sample locations: "Phase I and Phase II Environmental Site Assessment, Rico Colorado" by Walsh Environmental Scientists and Engineers, Inc. March 14, 1995.

Date of last revision: June 19, 2003
File: RicoDoloresWalsh1995.mxd

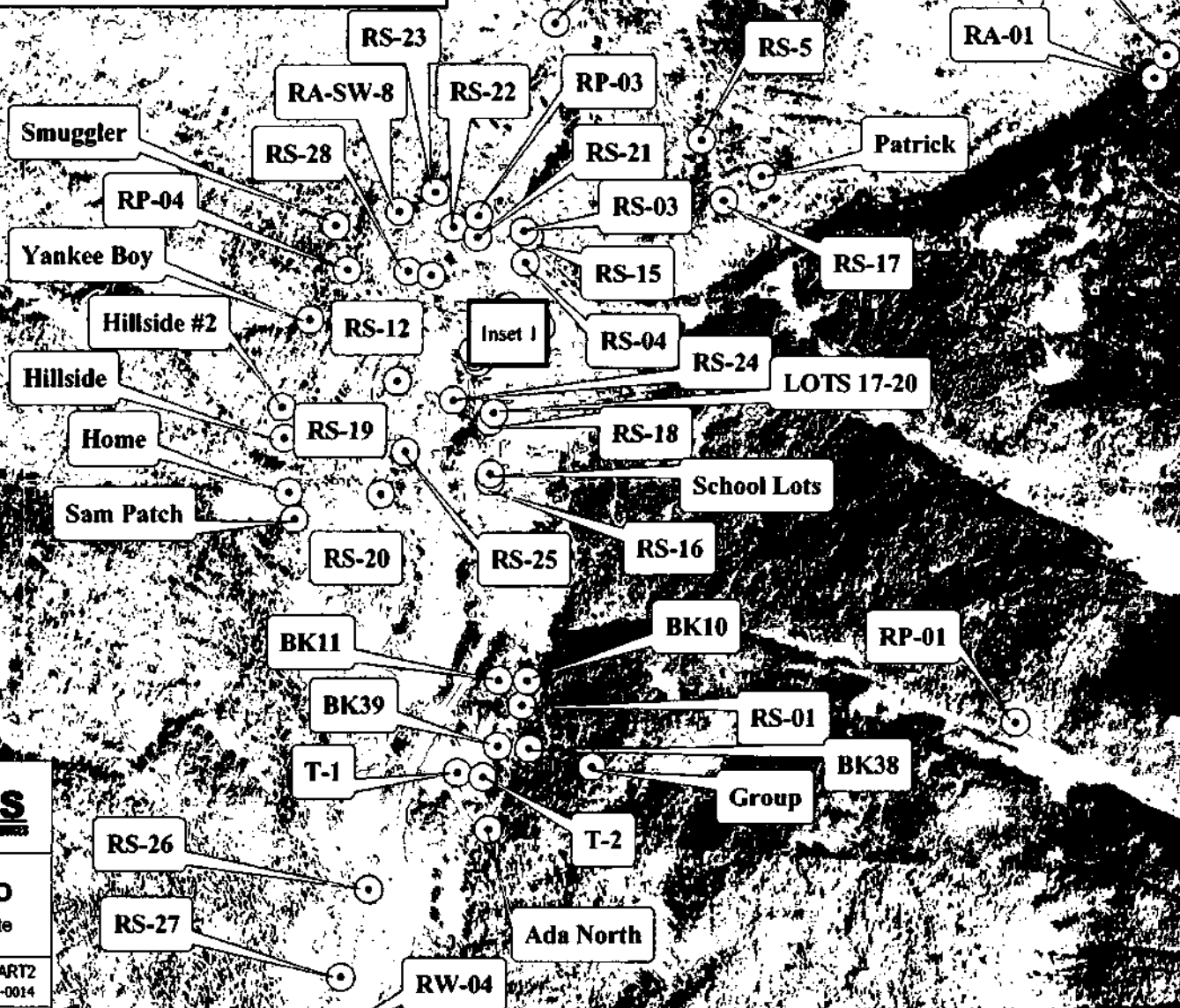
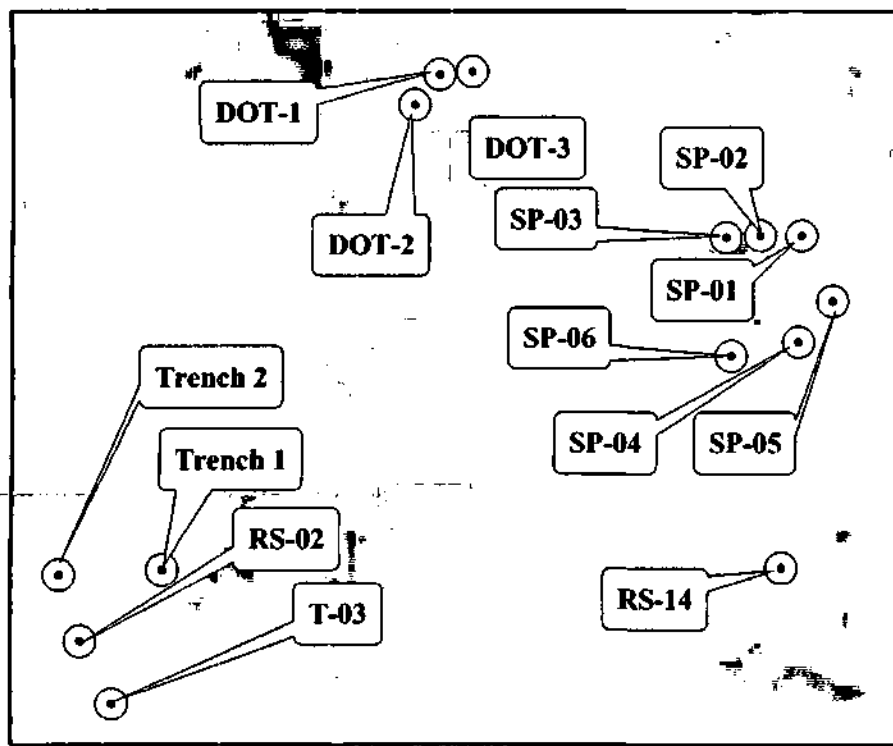
DRAFT
Note: Results data for the following sample locations could not be located: RA-SW-8, RS-14.



Location Map



Inset 1



URS
OPERATIONAL SERVICES

RICO PROJECT
DOLORES COUNTY, COLORADO
FIGURE 8: 1995 Phase II Environmental Site Assessment Sample Locations

November 2003

UOS - START2
TDD No. 0305-0014

Source: Walsh Environmental Scientists and Engineers, Inc. 2003

761500

762000

762500

4177500

4177500

4177000

4177000

4176500

4176500

4176000

4176000

4175500

4175500

761500

762000

762500



Water Quality Study: Dolores River 2002

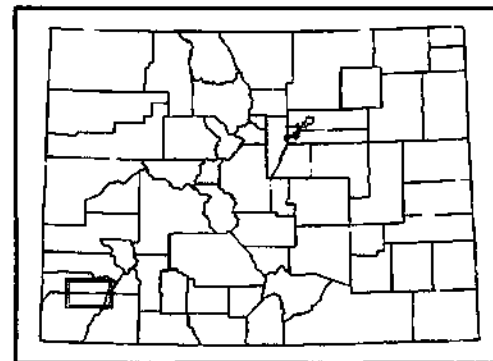
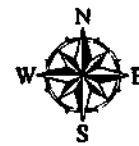
By Citizens For Accountability
and Responsibility (CFAR)

- Sample location and average
value for Summer 2002 sampling

Data sources:
Base: 1:250000 USGS Digital Raster Graphics (DRGs).
Sample locations: "Water Quality Study: Dolores River 2002"
by Citizens for Accountability and Responsibility (CFAR).

Date of last revision: June 19, 2003
File: RicoDoloresCFAR2002.mxd

DRAFT
Note: Missing Station Id
for last set of results in report

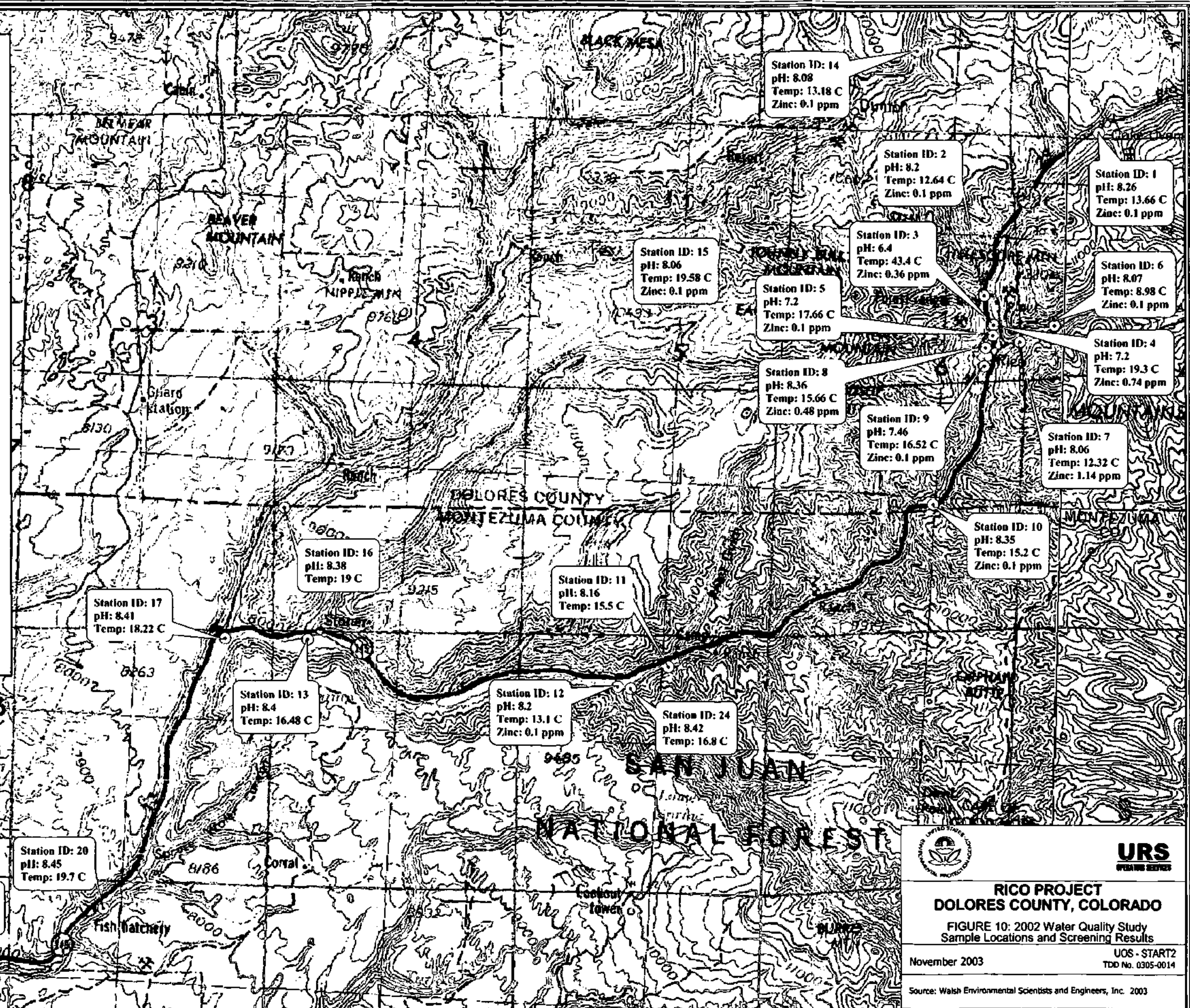


Location Map



0 0.5 1 2 3 4
Miles

NLS



URS
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DOLORES COUNTY, COLORADO

FIGURE 10: 2002 Water Quality Study
Sample Locations and Screening Results

November 2003

UOS - START2
TDD No. 0305-0014

Source: Walsh Environmental Scientists and Engineers, Inc. 2003

761000

762000

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OPERATING SERVICES**RICO PROJECT
DOLORES COUNTY, COLORADO**

FIGURE 11: 1996 Soils Study Sample Locations

November 2003

UOS - START2
TDD No. 0305-0014

○ Sample Location

Note: Lead concentration values are part per million (ppm)

Source: ESA 2000 (with corrections)
USGS Orthophotos 37108 f12-f13
Walsh Environmental Scientist
and Engineers, Inc.SCALE: 1:9,000
1" = 750'

500 0 500 1000 Feet

**COLORADO**
★*Denver*

Site Location

RC-5A1
Lead 14
RC-5A2
Lead 72
RC-5A3
Lead 8.9Flow
DirectionRC-7A
Lead 130RC-7B
Lead 86

Pond 18

Pond 15

Pond 16

Pond 14

Pond 13

Pond 12

Pond 11

Pond 10

Pond 9

Pond 8

Pond 7

Pond 6

RC-8A
Lead 38
RC-8B
Lead 1000RC-4C
Lead 240RC-4A
Lead 2200RC-4B
Lead 7000RC-9A
Lead 330
RC-9B
Lead 670RC-3A
Lead 5600
RC-3B
Lead 550
RC-3C
Lead 660RC-10C
Lead 110
RC-16A
Lead 110RC-6A
Lead 1100
RC-6B
Lead 340RC-2A
Lead 220
RC-2B
Lead 75
RC-2C
Lead 69
RC-2F
Lead 3600RC-21A
Lead 1800
RC-21B
Lead 1300
RC-21C
Lead 2300

761000

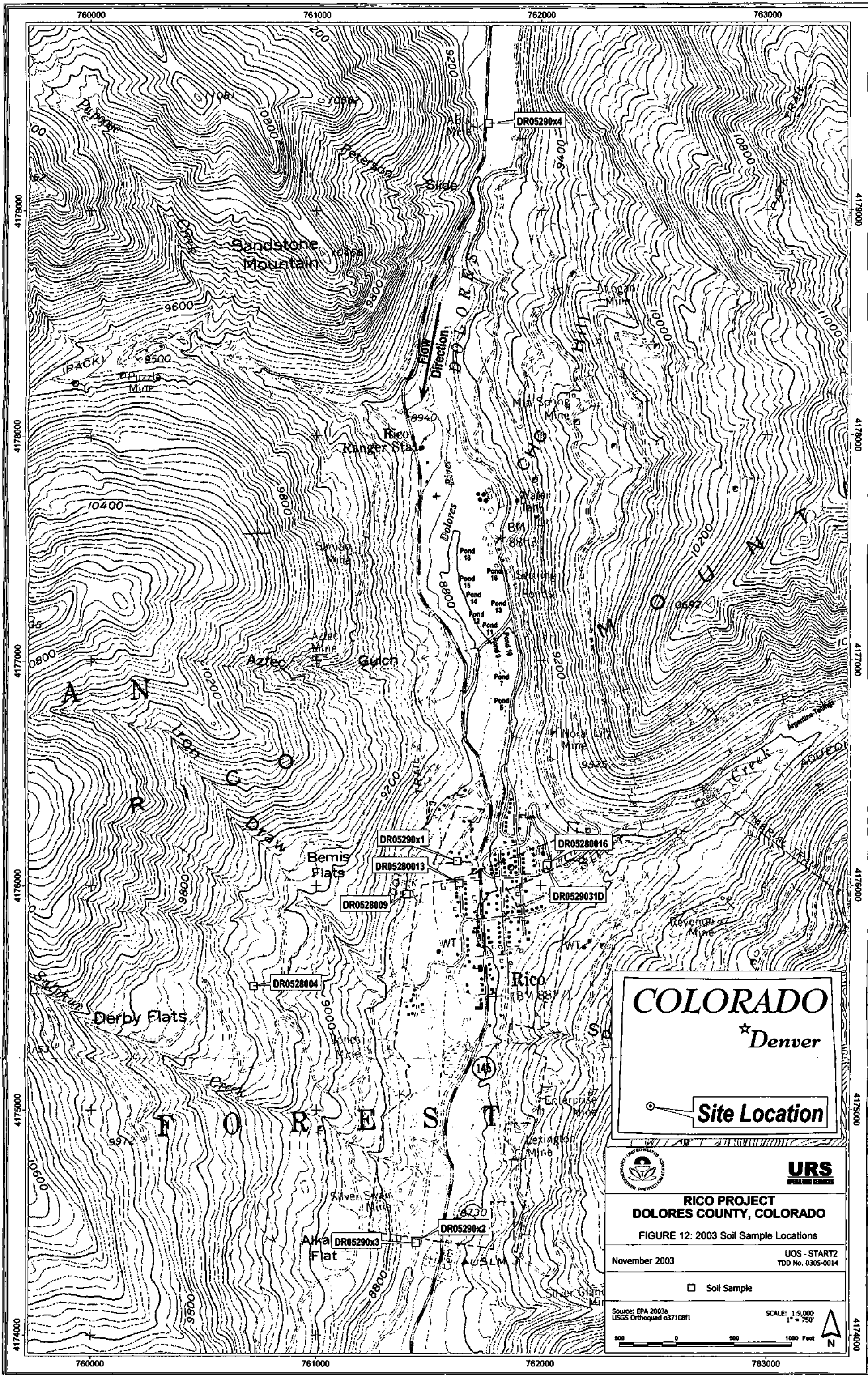
762000

4179000

4178000

4177000

4176000



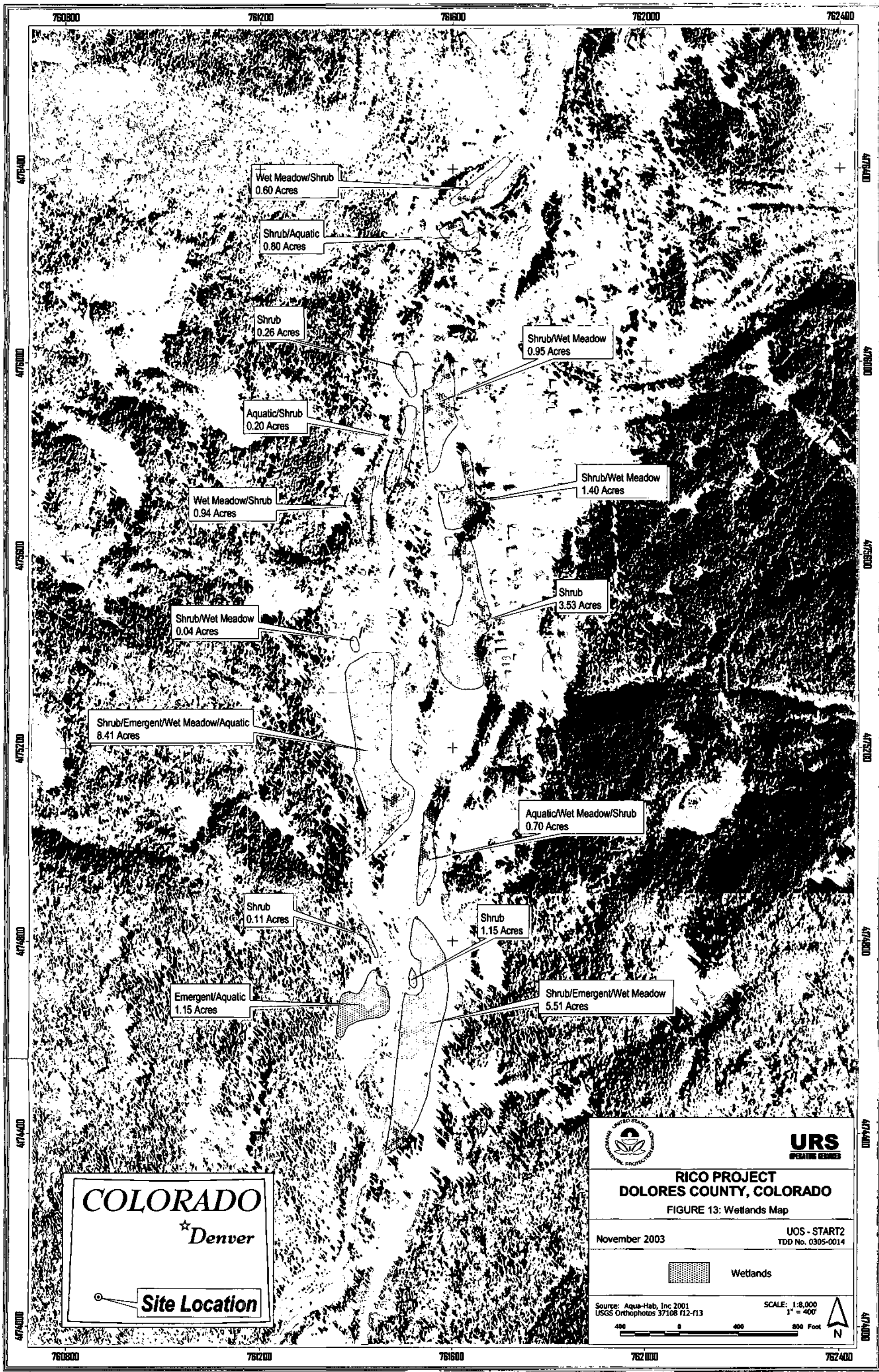


TABLE 1
CDPS Permit Violations
Concentrations in µg/L

Parameter	SCDM AWQC	CDPS Limit	Violation Date	Outfall 002 Reported 30-Day Average Concentration
Zinc	110	440	05/31/94	610
Copper	12	30	06/30/94	32
Lead	3.2	10	07/31/94	65
Cadmium	1.1	10	10/31/94	20
Zinc	110	237	03/31/95	950
Cadmium	1.1	0	03/31/95	3
Zinc	110	237	04/30/95	570
Cadmium	1.1	0	04/30/95	3.5
Zinc	110	237	05/31/95	750
Cadmium	1.1	0	05/31/95	6.5
Zinc	110	237	06/30/95	7,020
Cadmium	1.1	0	06/30/95	45
Zinc	110	237	07/31/95	2,850
Cadmium	1.1	0	07/31/95	12.5
Zinc	110	237	08/31/95	282
Zinc	110	237	09/30/95	370
Cadmium	1.1	0	09/30/95	2.5
Silver	4.1	0	10/31/95	5.5
Zinc	110	237	10/31/95	275
Silver	4.1	0	11/30/95	1
Zinc	110	237	11/30/95	320
Silver	4.1	0	12/31/95	3.5
Zinc	110	237	12/31/95	220
Silver	4.1	0	10/31/96	0.2
Zinc	110	237	02/29/96	255

TABLE 1
CDPS Permit Violations
Concentrations in $\mu\text{g/L}$
(continued)

Parameter	SCDM AWQC	CDPS Limit	Violation Date	Outfall 002 Reported 30-Day Average Concentration
Zinc	110	237	04/30/96	240
Cadmium	1.1	0	04/30/96	1.5
Zinc	110	237	05/31/96	280
Silver	4.1	0	06/30/96	10
Zinc	110	237	06/30/96	250
Silver	4.1	0	07/31/96	2
Silver	4.1	0	08/31/96	2.5
Zinc	110	237	08/31/96	275

Source: EPA 2003b; EPA 1996.

TABLE 2
1996 Expanded Site Inspection - Source Soils and Tailings Analytical Results
Concentrations in mg/kg

Sample ID: Case #: Traffic Report #: Location:		2352703 24008 MHCQ96 RA-WSO-01	2352704 24008 MHCQ97 RA-WSO-02	2350420 24008 MHDD89 RA-WSO-03	2350426 24008 MHDD95 RA-WSO-04	2350407 24008 MHDD76 RA-WSO-05	2350405 24008 MHDD74 RA-WSO-06	2350406 24008 MHDD75 RA-WSO-07
Location Description:		Soil sample from abandoned cyanide leach pits along the Dolores River	Soil sample from abandoned cyanide leach pits along the Dolores River	Tailings piles along Silver Creek	Tailings piles along Silver Creek	Tailings pile at confluence of Silver Creek and the Dolores River	Tailings pile along the Dolores River south of Rico	Tailings along the Dolores River one mile south of Rico
Aluminum	(Al)	15200 J	8210 J	2770 J	11800 J	9360 J	425 J	6210 J
Antimony	(Sb)	[7.6]	0.93 UJ	[5.2]	[7.8]	0.66 UJ	1.7 J	[4.8]
Arsenic	(As)	32.1 J	16.7 J	139 J	43.5 J	9.1 J	137 J	43.5 J
Barium	(Ba)	182	[55.6]	[42.8]	747	55.6	[39.4]	60.3
Beryllium	(Be)	1.5	6.0	2.8	1.5	1.2	[0.58]	0.23 U
Cadmium	(Cd)	0.25 UJ	68.7	0.24 UJ	19.2	79.1	32.7	4.4
Calcium	(Ca)	4120 J	135000 J	66800 J	54500 J	65900 J	62000 J	9090 J
Chromium	(Cr)	25.3	5.0	11.6	17.9	13.0	[1.6]	9.3
Cobalt	(Co)	[12.4]	[13.0]	[2.9]	13.7	[10.4]	[2.5]	[1.1]
Copper	(Cu)	233	1070	372	324	215	565	191
Iron	(Fe)	81500 J	62300 J	146000 J	39400 J	31900 J	103000 J	37800 J
Lead	(Pb)	833 J	165 J	5130 J	2170 J	4100 J	13300 J	3610 J
Magnesium	(Mg)	11500	11500	2120	33700	9540	[107]	5830
Manganese	(Mn)	2130 J	6010 J	1410 J	12300 J	3980 J	62.3 J	213 J
Mercury	(Hg)	0.16	0.16 U	0.12 U	0.30	0.48	0.21	0.37
Nickel	(Ni)	24.7	19.1	[4.5]	27.2	15.7	[2.7]	[4.6]
Potassium	(K)	3290 J	1040 J	3410	2320	1450 J	2180	2420
Selenium	(Se)	2.2	0.62 U	5.6	1.1 J	0.44 U	3.5	2.5 J
Silver	(Ag)	28.0	3.3	21.8	127	30.9	45.7	17.7
Sodium	(Na)	38.6 UJ	44.2 UJ	34.7 UJ	34.9 UJ	31.4 UJ	33.9 UJ	33.3 UJ
Thallium	(Tl)	4.7 J	2.7 UJ	4.9	2.2 UJ	1.3 UJ	10.4	1.8 UJ
Vanadium	(V)	19.9	[3.4]	23.6	17.5	16.5	[1.8]	12.0
Zinc	(Zn)	691 J	14900 J	1850 J	2960 J	10400 J	5450 J	915 J
Cyanide	(CN)	4.6	0.23 U	4.2	5.4	[0.20]	[0.40]	0.18 U

J The associated numerical value is an estimated quantity because quality control criteria were not met.

U The analyte was not detected at reported concentration (qualified by laboratory software).

UJ The associated numerical value is an estimated quantity because quality control criteria were not met. The analyte was not detected.

[] The associated numerical value was detected below the CRDL, but greater than the method detection limit and is therefore an estimate (qualified by laboratory software). Presence of the compound is reliable.

Source: URS 1996.

TABLE 3
1996 Expanded Site Inspection - St. Louis Ponds Source Sediment Analytical Results
Concentrations in mg/kg

Sample ID: Case #: Traffic Report #: Location:	2352713 24008 MHDA95 RA-WSE-01	2352707 24008 MHDA89 RA-WSE-02	2352709 24008 MHDA91 RA-WSE-03
Location Description	Sediment sample from uppermost settling pond adjacent to the Dolores River	Sediment sample from lowermost settling pond adjacent to the Dolores River	Sediment sample from ditch adjacent to upper settling ponds along the Dolores River
Aluminum (Al)	25500 J	8560 J	3620 J
Antimony (Sb)	19.6 UJ	1.8 UJ	0.88 U
Arsenic (As)	49.4	12.9	10.6
Barium (Ba)	[94.5]	[44.7]	[54.2]
Beryllium (Be)	13.6	1.3 U	0.48 UJ
Cadmium (Cd)	227	10.9	[0.32]
Calcium (Ca)	153000 J	13700 J	5700 J
Chromium (Cr)	[15.5]	13.5	4.2
Cobalt (Co)	[40.5]	[12.5]	[4.4]
Copper (Cu)	4250 J	69.2 J	12.8 J
Iron (Fe)	195000 J	19800 J	12300 J
Lead (Pb)	838 J	137 J	19.0 J
Magnesium (Mg)	[8470]	7530	2290
Manganese (Mn)	18600 J	3900 J	483 J
Mercury (Hg)	1.2 U	0.13 U	0.15 U
Nickel (Ni)	[63.7]	20.2	[8.2]
Potassium (K)	[8050]	1660	[1240]
Selenium (Se)	4.8 U	0.54 U	0.59 U
Silver (Ag)	[8.0]	[2.3]	0.29 U
Sodium (Na)	2480 UJ	38.0 U	75.8 UJ
Thallium (Tl)	4.8 U	0.54 U	0.59 U
Vanadium (V)	[9.0]	[10.5]	[10.1]
Zinc (Zn)	43900 J	1300 J	79.3 J
Cyanide (CN)	[3.1]	0.20 U	0.22 U

- J The associated numerical value is an estimated quantity because quality control criteria were not met.
 U The analyte was not detected at reported concentration (qualified by laboratory software).
 UJ The associated numerical value is an estimated quantity because quality control criteria were not met. The analyte was not detected.
 [] The associated numerical value was detected below the CRDL, but greater than the method detection limit and is therefore an estimate (qualified by laboratory software). Presence of the compound is reliable.

Source: URS 1996.

TABLE 4
1996 Expanded Site Inspection - St. Louis Ponds Source Surface Water Analytical Results - Total Metals
Concentrations in µg/L

Sample ID: Case #: Traffic Report #: Location:	2352711 24008 MHDA93 RA-WSW-01	2352706 24008 MHDA88 RA-WSW-02	2352708 24008 MHDA90 RA-WSW-03	2352710 24008 MHDA92 RA-WSW-09
Location Description	Aqueous sample from uppermost settling pond adjacent to the Dolores River	Aqueous sample from lowermost settling pond adjacent to the Dolores River	Aqueous sample from ditch adjacent to upper settling ponds along the Dolores River	Aqueous sample from spring trickling out into rocks beneath cyanide leach pond
Aluminum (Al)	3860 J	53.3 J	22.1 UJ	234 J
Antimony (Sb)	3.0 U	3.0 U	3.0 U	3.0 U
Arsenic (As)	[6.9]	2.0 U	2.0 U	2.0 U
Barium (Ba)	[23.9]	[13.1]	[48.1]	[40.3]
Beryllium (Be)	2.3 UJ	1.0 U	1.0 U	1.0 U
Cadmium (Cd)	26.4	[1.9]	1.0 U	1.0 U
Calcium (Ca)	215000	206000	67100	72900
Chromium (Cr)	[1.9]	1.0 U	1.0 U	1.0 U
Cobalt (Co)	[5.2]	1.0 U	1.0 U	1.0 U
Copper (Cu)	453	[4.2]	4.0 U	[4.9]
Iron (Fe)	28500	297	369	537
Lead (Pb)	172	1.0 U	1.0 U	44.7
Magnesium (Mg)	19800	20200	8750	9000
Manganese (Mn)	2950	820	334	45.4
Mercury (Hg)	0.20 U	0.20 U	0.20 U	0.20 U
Nickel (Ni)	[10.0]	[2.4]	1.0 U	1.0 U
Potassium (K)	5050	[4830]	[3230]	2380 J
Selenium (Se)	2.0 U	2.0 U	2.0 U	2.0 U
Silver (Ag)	[1.2]	1.0 U	1.0 U	1.0 U
Sodium (Na)	9010	9110	[1700]	[1880]
Thallium (Tl)	[4.3]	[3.4]	2.2 UJ	[2.8]
Vanadium (V)	[1.5]	1.0 U	1.0 U	1.0 U
Zinc (Zn)	5660	351	27.2 UJ	49.2
Cyanide (CN)	3.0 U	3.0 U	3.0 UJ	3.0 U

- J The associated numerical value is an estimated quantity because quality control criteria were not met.
 U The analyte was not detected at reported concentration (qualified by laboratory software).
 UJ The associated numerical value is an estimated quantity because quality control criteria were not met. The analyte was not detected.
 [] The associated numerical value was detected below the CRDL, but greater than the method detection limit and is therefore an estimate (qualified by laboratory software). Presence of the compound is reliable.

Source: URS 1996.

TABLE 5
1998 Compliance Inspection
Source Analytical Results
Concentrations in $\mu\text{g/l}$

Location Description:		Method	SCDM AWQC	St. Louis Tunnel Outfall 002	Blaine Tunnel Outfall 001
Cadmium	(Cd)	200.7-3120 B	1.1	16.8	1,490
Copper	(Cu)	200.7-3120 B	12	16.3	27,400
Lead ¹	(Pb)	239.2-3113 B	3.2	15.1	57.3
Silver	(Ag)	272.2-3113 B	4.1	1.12	1.32
Zinc	(Zn)	200.7-3120 B	110	1,850	176,000

¹ Lead results are questionable due to possible lab error.

Source: EPA 1998a.

TABLE 6
2000 Emergency Response
Source Surface Water Analytical Results - Total Metals
Concentrations in µg/L (ppb)

Sample ID: Lab Sample ID: Location:	SCDM AWQC Fresh Water	RS-SW-4 Q1241-4 Upstream of settling ponds on Dolores River (background)	RS-SW-1 Q1241-1 Impoundment east of primary pond	RS-SW-2 Q1241-2 Primary settling pond	RS-SW-6 Q1241-6 Duplicate of RS-SW-2	RS-SW-3 300Q1241-3 Downstream of primary settling pond	RS-SW-5 Q1241-5 NPDES discharge pond
Aluminum (Al)		334	339	264	274	300	[46.6]
Antimony (Sb)		2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Arsenic (As)	190	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
Barium (Ba)		72.8	25.2	24.1	23.3	71.1	20.9
Beryllium (Be)		[0.28]	[0.88]	[0.58]	[0.60]	[0.24]	[0.32]
Cadmium (Cd)	1.1	0.20 U	21.5	17.4	16.8	0.20 U	5.7
Calcium (Ca)		32,000	250,000	245,000	236,000	33,100	236,000
Chromium (Cr)	11	0.40 U	0.40 U	0.40 U	[0.56]	0.40 U	0.40 U
Cobalt (Co)		0.50 U	[4.0]	[3.2]	[3.1]	0.50 U	[1.8]
Copper (Cu)	12	0.60 U	42.7	27.0	21.7	0.60 U	[2.5]
Iron (Fe)	1,000	276	6,080	2,600	2,280	277	717
Lead (Pb)	3.2	1.3 U	4.8	10.7	9.5	1.3 U	[2.8]
Magnesium (Mg)		5,110	20,600	20,900	20,200	5,180	21,300
Manganese (Mn)		27.9	2,100	1,900	1,830	46.4	1,540
Mercury (Hg)	0.012	[0.12]	[0.13]	0.10 U	[0.11]	0.10 U	[0.11]
Nickel (Ni)	160	[0.75]	7.3	5.5	5.9	[1.1]	[3.5]
Potassium (K)		[801]	1,810	1,810	1,740	[792]	2,600
Selenium (Se)	5.0	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Silver (Ag)	4.1	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U
Sodium (Na)		2,470	13,000	11,800	11,300	2,480	12,600
Thallium (Tl)		3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium (V)		[0.67]	[0.81]	0.40 U	0.40 U	[0.64]	0.40 U
Zinc (Zn)	110	[1.4]	4,490	3,570	3,400	[2.6]	1,320

U Analyte not detected at laboratory reporting limit
 [] Estimated value. Analyte detected below the laboratory reporting limit
 ppb parts per billion
 µg/L micrograms per liter
 AWQC Ambient Water Quality Criteria / Acute and Chronic Aquatic Life Advisory Concentrations
 Above SCDM benchmarks.

Source: URS 2000; EPA 1996. Superfund Chemical Data Matrix (SCDM): <http://www.epa.gov/superfund/resources/scdm/> June 1996.

TABLE 7
2000 Emergency Response
Source Sediment Analytical Results
Concentrations in mg/kg (ppm)

Sample ID: Lab Sample ID: Location:	RS-SE-4 R1241-4 Upstream of settling ponds on Dolores River (background)	RS-SE-1 R1241-1 Impoundment east of primary pond	RS-SE-2 R1241-2 Primary settling pond	RS-SE-6 R1241-6 Duplicate of RS-SE-2	RS-SE-3 R1241-3 Downstream of primary settling pond	RS-SE-5 R1241-5 NPDES discharge pond
Aluminum (Al)	5,490	31,000	14,100	13,800	5,170	12,100
Antimony (Sb)	[0.80]	[8.5]	[2.6]	[2.5]	[0.42]	[4.5]
Arsenic (As)	10.1	48.4	11.4	12.6	9.5	35.1
Barium (Ba)	104	280	29.5	54.3	89.3	200
Beryllium (Be)	[0.64]	19.2	8.5	8.6	0.65	4.3
Cadmium (Cd)	0.76	115	114	113	[0.40]	51.4
Calcium (Ca)	9,670	26,000	83,400	88,300	36,600	7,790
Chromium (Cr)	7.4	38.4	11.3	10.1	7.6	15.7
Cobalt (Co)	5.8	24.4	12.7	14.2	5.6	56.9
Copper (Cu)	26.3	4,190	2,460	2,370	14.7	722
Iron (Fe)	16,900	281,000	128,000	120,000	14,900	80,200
Lead (Pb)	41.6	1,180	200	276	26.3	796
Magnesium (Mg)	4,250	17,600	2,660	4,160	4,060	7,040
Manganese (Mn)	830	10,900	4,260	5,330	508	19,000
Mercury (Hg)	[0.05]	[0.38]	[0.21]	[0.15]	0.04	[0.11]
Nickel (Ni)	11.8	44.4	23.3	24.2	11.3	40.8
Potassium (K)	1,080	2,990	[225]	[459]	1,310	1,730
Selenium (Se)	0.33 U	3.9 U	2.3 U	1.5 U	0.26 U	3.4
Silver (Ag)	[0.62]	19.5	[0.85]	[2.1]	0.07 U	17.0
Sodium (Na)	[216]	3,980	8,600	1,990 U	[224]	1,400
Thallium (Tl)	[1.4]	27.1	12.9	11.7	[0.70]	6.7
Vanadium (V)	14.9	41.6	[7.5]	[8.4]	12.9	18.0
Zinc (Zn)	157	23,700	27,000	25,300	94.1	7,760

U Analyte not detected at laboratory reporting limit
 [] Estimated value. Analyte detected below the laboratory reporting limit
 mg/kg milligrams per kilogram
 ppm parts per million

Source: URS 2000

TABLE 8
2000 ARCO Water Quality and Discharge Monitoring - Source and Surface Water Analytical Results
Concentrations in µg/L

Sample ID: Location Description:	EPA Method	SCDM AWQC	DR-1 Dolores River Above Ponds (Background)	DR-2 Dolores River Above Outfall	DR-7 Dolores River Below Ponds	DR-3 Tunnel Discharge	DR-4 Pond 18 Discharge	DR-5 Pond 11 Discharge	DR-6 Outfall 002	DR-8 Goothermal Discharge	DR-9 Pond 13 Discharge	SC-1 Silver Creek above Blaine Adit (Background)	SC-2 Blaine Adit	SC-3 Silver Creek Below Blaine Adit
Dissolved Metals														
Cadmium (Cd)	7131	1.1	0.15	0.20	0.70	18	10	6.3	5.9	0.11	10	1.4	7,000	4.1
Copper (Cu)	6010	12	<10	30	<10	30	<10	<10	<10	<10	<10	10	5,200	20
Iron (Fe)	7381	1,000	<20	<20	<20	350	<20	<20	<20	3,880	<20	<20	844,000	60
Lead (Pb)	7421	3.2	<0.5	0.70	<0.5	<0.5	<0.5	<0.5	<0.5	0.50	<0.5	3.2	505	0.90
Manganese (Mn)	6010	-	12	163	443	2,660	2,650	2,550	1,970	1,200	4,840	9.6	149,000	230
Silver (Ag)	7761	4.1	<0.02	0.08	<0.02	<0.02	<0.02	0.05	0.05	<0.02	0.06	<0.02	1.4	<0.02
Zinc (Zn)	6010	110	20	<10	160	3,600	2,620	1,790	1,410	90	1,970	770	230,000	380
Total Metals														
Cadmium (Cd)	7131	1.1	na	na	na	15	14	6.8	8.6	0.13	12	na	na	na
Copper (Cu)	6010	12	na	na	na	100	40	<10	<10	<10	<10	na	na	na
Iron (Fe)	7381	1,000	na	na	na	3,210	210	580	450	4,690	960	na	na	na
Lead (Pb)	7421	3.2	na	na	na	1.6	0.80	<0.5	<0.5	0.60	<0.5	na	na	na
Manganese (Mn)	6010	-	na	na	na	2,730	2,700	2,670	2,070	1,220	5,160	na	na	na
Silver (Ag)	7761	4.1	na	na	na	<0.02	0.02	0.04	0.05	0.09	0.09	na	na	na
Zinc (Zn)	6010	110	na	na	na	3,670	2,780	2,170	1,530	270	2,420	na	na	na

na Not analyzed
Above SCDM benchmarks.

Source: ESA 2000 and EPA 1996

TABLE 9
July 2002 ARCO Water Quality and Discharge Monitoring
Source and Surface Water Analytical Results
Concentrations in µg/L

Sample ID: Location Description:	Method	SCDM AWQC	DR-3 St. Louis Tunnel	DR-6 Outfall 002	DR-1 Dolores River Above Ponds (Background)	DR-20 Dolores River West of Pond 14	DR-2 Dolores River Above Outfall	DR-7 Dolores River Below Ponds	DR-2-SW Dolores River Above Columbia Tailings	DR-1-SW Side Channel Columbia Tailings Seep	DR-26 Dolores River Below Columbia Seep and Above Wetlands
Dissolved Metals											
Cadmium (Cd)	M200.7 ICP	1.1	13	U	3	U	U	U	U	U	U
Copper (Cu)	M200.7 ICP	12	20	3	U	U	2	1	2	3	1
Cyanide (CN)	SM4500-CN	5.2	U	U	U	U	U	U	U	U	U
Iron (Fe)	M200.7 ICP	1,000	2360	30	na	na	na	na	na	na	na
Lead (Pb)	M200.8 ICP-MS	3.2	16.7	U	U	U	0.3	U	0.2	U	U
Manganese (Mn)	M200.7 ICP	-	2050	505	13	79	307	316	210	188	229
Mercury (Hg)	M1631	0.012	U	na	na	na	na	na	na	na	na
Nickel (Ni)	M200.7 ICP	160	U	U	U	U	U	U	U	U	U
Selenium (Se)	M200.8 ICP-MS	5.0	U	U	U	U	U	U	U	U	U
Silver (Ag)	M200.8 ICP-MS	4.1	U	U	U	U	U	U	U	U	U
Zinc (Zn)	M200.7 ICP	110	3430	410	20	20	20	20	50	580	80
Total Metals											
Arsenic (As)	M200.8 ICP-MS	190	1.7	U	na	na	na	na	na	U	na
Cadmium (Cd)	M200.7 ICP	1.1	18	na	na	na	na	na	na	na	na
Chromium (Cr)	M200.8 ICP-MS	11	9.8	1.6	U	0.1	0.1	1.7	1.3	U	1.4
Copper (Cu)	M200.7 ICP	12	250	na	na	na	na	na	na	na	na
Iron (Fe)	M200.7 ICP	1,000	13900	390	50	90	90	170	120	530	160
Manganese (Mn)	M200.7 ICP	-	2160	na	na	na	na	na	na	na	na
Zinc (Zn)	M200.7 ICP	110	3280	na	na	na	na	na	na	na	na
Mercury (Hg)	M1631	0.012	na	na	U	na	na	U	na	na	na

na Not analyzed
 U Not detected at minimum detection limit (MDL)
 C Sample was retested; both results shown.
☐ Above SCDM benchmarks.

Source: Short Elliott Hendrickson 2002a; EPA 1996

TABLE 9
July 2002 ARCO Water Quality and Discharge Monitoring
Source and Surface Water Analytical Results
Concentrations in µg/L
(continued)

Sample ID: Location Description:	Method	SCDM AWQC	DR-9-SW Rico Boy/Santa Cruz Wetland Outlet	DR-27 Rico Boy Santa Cruz Combined Flow	DR-7-SW Silver Swan Adit	DR-4-SW Dolores River Below Silver Swan	SVS-22 Silver Creek Above Argentine Tailings Seep	SVS-12 Argentine Tailings Seep	SVS-8 Silver Creek Below Argentine Seep	SVS-26 Discharge Downstream of Overhead Tramway	SVS-20 Silver Creek Just Above Dolores River
Dissolved Metals											
Cadmium (Cd)	M200.7 ICP	1.1	U	U	U	U	4	4	3	16	4
Copper (Cu)	M200.7 ICP	12	2	10	2	1	2	2	2	51	2
Cyanide (CN)	SM4500-CN	5.2	U	U	U	U	U	U	U	U	U
Iron (Fe)	M200.7 ICP	1,000	na	na	na	na	na	na	na	na	na
Lead (Pb)	M200.8 ICP-MS	3.2	U	U	1.3	U	0.5	1.7	U	40.7	0.5
Manganese (Mn)	M200.7 ICP	-	9060	86	2690	21/U C	U	7200	648	10800	12
Mercury (Hg)	M1631	0.012	na	na	na	na	na	na	na	na	na
Nickel (Ni)	M200.7 ICP	160	U	U	U	U	U	20	U	U	U
Selenium (Se)	M200.8 ICP-MS	5.0	U	U	U	U	U	U	U	U	U
Silver (Ag)	M200.8 ICP-MS	4.1	U	U	U	0.2	U	U	U	U	U
Zinc (Zn)	M200.7 ICP	110	40	920	880	10/30 C	420	6110	940	8050	470
Total Metals											
Arsenic (As)	M200.8 ICP-MS	190	na	U	5.1	na	na	0.8	na	U	na
Cadmium (Cd)	M200.7 ICP	1.1	na	na	na	na	na	na	na	na	na
Chromium (Cr)	M200.8 ICP-MS	11	U	U	1.5	1.4	U	U	0.1	U	U
Copper (Cu)	M200.7 ICP	12	na	na	na	na	na	na	na	na	na
Iron (Fe)	M200.7 ICP	1,000	1690	10	14700	120	U	5780	90	14800	10
Manganese (Mn)	M200.7 ICP	-	na	na	na	na	na	na	na	na	na
Zinc (Zn)	M200.7 ICP	110	na	na	na	na	na	na	na	na	na
Mercury (Hg)	M1631	0.012	na	U	U	na	na	U	na	na	U

na Not analyzed
U Not detected at minimum detection limit (MDL)
C Sample was retested; both results shown.
Above SCDM benchmarks.

Source: Short Elliott Hendrickson 2002a; EPA 1996

TABLE 10
October 2002 ARCO Water Quality and Discharge Monitoring Source and Surface Water Analytical Results
Concentrations in µg/L

Sample ID: Location Description:	Method	SCDM AWQC	DR-3 St. Louis tunnel	DR-6 Outfall 002	DR-1 Dolores River Above Ponds (Background)	DR-20 Dolores River West of Pond 14	DR-2 Dolores River Above Outfall	DR-7 Dolores River Below Ponds	DR-2-SW Dolores River Above Columbia Tailings	DR-1-SW Side Channel Columbia Tailings Seep	DR-26 Dolores River Below Columbia Seep and Above Wetlands
Dissolved Metals											
Cadmium (Cd)	M200.7 ICP	1.1	13.8	1.7	3	U	U	U	0.2 B	2.6	0.2 B
Copper (Cu)	M200.7 ICP	12	30 B	4.7	1	0.3 B	0.8	0.2 B	1.5 B	U	0.2 B
Cyanide (CN)	SM4500-CN	5.2	U	U	5	U	U	U	U	U	U
Iron (Fe)	M200.7 ICP	1,000	4120	20 B	na	na	na	na	na	na	na
Lead (Pb)	M200.8 ICP-MS	3.2	13.2	U	0.2	U	U	U	U	0.2 B	U
Manganese (Mn)	M200.7 ICP	-	1830	296	5	45	115	135	130	229	163
Mercury (Hg)	M1631	0.012	0.0003 B	0.0004 B	na	na	na	na	na	na	na
Nickel (Ni)	M200.7 ICP	160	10 B	U	10	U	U	U	U	U	U
Selenium (Se)	M200.8 ICP-MS	5.0	U	U	3	U	U	U	U	U	U
Silver (Ag)	M200.8 ICP-MS	4.1	0.18 B	U	0.1	U	U	U	U	U	U
Zinc (Zn)	M200.7 ICP	110	2970	400	10	U	U	U	40 B	850	60
Total Metals											
Arsenic (As)	M200.8 ICP-MS	190	2.1 B	U	0.5	na	na	na	na	U	na
Cadmium (Cd)	M200.7 ICP	1.1	14.4	na	na	na	na	na	na	na	na
Chromium (Cr)	M200.8 ICP-MS	11	0.6 B	0.2 B	0.1	1.0 B	1.0 B	0.9 B	0.8	3.5	1.2 B
Copper (Cu)	M200.7 ICP	12	220	na	na	na	na	na	na	na	na
Iron (Fe)	M200.7 ICP	1,000	12000	300	10	100	120	180	230	480	180
Manganese (Mn)	M200.7 ICP	-	1950	na	.0002	na	na	na	na	na	na
Zinc (Zn)	M200.7 ICP	110	3200	na	na	na	na	na	na	na	na
Mercury (Hg)	M1631	0.012	na	na	na	na	na	0.0010	na	na	na

na Not analyzed
U Not detected at minimum detection limit (MDL)
C Sample was retested; both results shown.
Above SCDM benchmarks.

Source: Short Elliott Hendrickson 2002a; EPA 1996

TABLE 10
October 2002 ARCO Water Quality and Discharge Monitoring
Source and Surface Water Analytical Results
Concentrations in µg/L
(continued)

Sample ID: Location Description:	Method	SCDM AWQC	DR-9-SW Rico Boy/Santa Cruz Wetland Outlet	DR-10-SW Rico Boy/Santa Cruz Wetland Outlet	DR-27 Rico Boy Santa Cruz Combined Flow	DR-7-SW Silver Swan Adit	DR-4-SW Dolores River Below Silver Swan	SVS-22 Silver Creek Above Argentine Tailings Seep	SVS-12 Argentine Tailings Seep	SVS-8 Silver Creek Below Argentine Seep	SVS-26 Discharge Downstream of Overhead Tramway	SVS-20 Silver Creek Just Above Dolores River
Dissolved Metals												
Cadmium (Cd)	M200.7 ICP	1.1	0.2 B	U	0.8	0.2 B	0.2 B	1.2	0.8	1.2	11.5	1.5
Copper (Cu)	M200.7 ICP	12	0.3 B	0.2 B	11.1	U	1.2 B	2.2 B	3.1	2.3 B	3 B	2.2 B
Cyanide (CN)	SM4500-CN	5.2	U	U	U	U	U	U	U	U	U	U
Iron (Fe)	M200.7 ICP	1,000	na	na	na	na	na	na	na	na	na	na
Lead (Pb)	M200.8 ICP-MS	3.2	0.2 B	U	0.1 B	1.1	U	1	U	0.5	U	0.3 B
Manganese (Mn)	M200.7 ICP	-	1180	228	56	2640	143	12 B	5760	269	11400	56
Mercury (Hg)	M1631	0.012	na	na	na	na	na	na	na	na	na	na
Nickel (Ni)	M200.7 ICP	160	U	U	U	U	U	U	10 B	U	30 B	U
Selenium (Se)	M200.8 ICP-MS	5.0	U	U	U	U	U	U	U	U	U	U
Silver (Ag)	M200.8 ICP-MS	4.1	U	U	U	0.19 B	U	U	U	U	0.08 B	U
Zinc (Zn)	M200.7 ICP	110	30 B	30 B	690	760	50	290	5070	490	8120	390
Total Metals												
Arsenic (As)	M200.8 ICP-MS	190	na	na	U	6.6	U	na	U	na	U	U
Cadmium (Cd)	M200.7 ICP	1.1	na	na	na	na	na	na	na	na	na	na
Chromium (Cr)	M200.8 ICP-MS	11	1.4 B	1.9 B	02 B	U	0.9	0.2 B	0.1 B	0.2 B	U	0.1 B
Copper (Cu)	M200.7 ICP	12	na	na	na	na	na	na	na	na	na	na
Iron (Fe)	M200.7 ICP	1,000	1120	150	80 B	13700	190	80	4720	130	15200	20 B
Manganese (Mn)	M200.7 ICP	-	na	na	na	na	na	na	na	na	na	na
Zinc (Zn)	M200.7 ICP	110	na	na	na	na	na	na	na	na	na	na
Mercury (Hg)	M1631	0.012	na	na	U	0.0003 B	0.0011	na	U	na	0.0006	0.0003 B

na Not analyzed
U Not detected at minimum detection limit (MDL)
C Sample was retested; both results shown.
Above SCDM benchmarks.

Source: Short Elliott Hendrickson 2002a; EPA 1996.

TABLE 11
1995 Phase II Environmental Site Assessment
Surface Water Analytical Results
Concentrations in $\mu\text{g/L}$

Sample ID: Location Description:	SCDM AWQC	RW-01	RW-02	RW-03	RW-04	RW-05
Aluminum (Al)		200 U	180,000	200	400	400
Antimony (Sb)		200 U	200 U	200 U	200 U	200 U
Arsenic (As)	190	200 U	200 U	200 U	200 U	200 U
Barium (Ba)		500 U	500 U	500 U	500 U	500 U
Beryllium (Be)		20 U	20 U	20 U	20 U	20 U
Cadmium (Cd)	1.1	20 U	0.33	20 U	20 U	20 U
Chromium (Cr)	11	50 U	50 U	50 U	50 U	50 U
Cobalt (Co)		50 U	0.13	50 U	50 U	50 U
Copper (Cu)	12	50 U	12	50 U	50 U	50 U
Iron (Fe)	1000	0.13	0.39	0.34	0.13	0.09
Lead (Pb)	3.2	200 U	200 U	200 U	200 U	200 U
Manganese (Mn)		0.11	40	0.76	0.06	50 U
Mercury (Hg)	0.012	1 U	1 U	1 U	1 U	1 U
Molybdenum (Mo)		50 U	50 U	50 U	50 U	50 U
Nickel (Ni)	160	50 U	50 U	50 U	50 U	50 U
Selenium (Se)	5	200 U	200 U	200 U	200 U	200 U
Silver (Ag)	4.1	100 U	100 U	100 U	100 U	100 U
Thallium (Tl)		200 U	200 U	200 U	200 U	200 U
Titanium (Ti)		50 U	50 U	50 U	50 U	50 U
Vanadium (V)		100 U	100 U	100 U	100 U	100 U
Zinc (Zn)	110	0.22	40	0.39	0.08	50 U

U Not detected at minimum detection limit (MDL).

Source: WALSH 1995; EPA 1996.

TABLE 12
1996 Expanded Site Inspection
Silver Creek Surface Water Analytical Results - Total Metals
Concentrations in $\mu\text{g/L}$

Sample ID: Case #: Traffic Report: Sample Location:	SCDM AWQC	RA-SW-05 24008 MHDD96 Silver Creek Background	RA-SW-06 24008 MHDD87 Silver Creek below tailings piles	RA-SW-07 24008 MHDD82 Silver Creek, just before confluence with the Dolores River
Aluminum		16.0 UJ	94.2 UJ (0.2)	20.6 UJ
Antimony		3.0 U	3.0 U	3.0 U
Arsenic	190	2.0 U	2.0 U	2.0 U
Barium		[123]	[95.8]	[87.9]
Beryllium		1.0 U	1.0 U	1.0 U
Cadmium	1.1	1.0 U	[1.8]	[2.1]
Calcium		33,800	54,700	69,100
Chromium	11	1.0 U	1.0 U	1.0 U
Cobalt		1.0 U	1.0 U	1.0 U
Copper	12	1.0 U	[2.2]	[1.8]
Iron	1,000	10.0 U	★ 919 (0.1)	★ 159 (0.1)
Lead	3.2	1.0 U	3.9 (0.003)	[1.1]
Magnesium		[3,380]	7,120	7,890
Manganese		1.0 U	★ 484 (0.015)	★ 192 (0.015)
Mercury	0.012	0.20 U	0.20 U	0.20 U

TABLE 12
1996 Expanded Site Inspection
Silver Creek Surface Water Analytical Results - Total Metals
Concentrations in $\mu\text{g/L}$
(continued)

Sample ID: Case #: Traffic Report: Sample Location:	SCDM AWQC	RA-SW-05 24008 MHDD96 Silver Creek Background	RA-SW-06 24008 MHDD87 Silver Creek below tailings piles	RA-SW-07 24008 MHDD82 Silver Creek, just before confluence with the Dolores River
Nickel	160	1.0 U	[1.0]	[1.0]
Potassium		834 U	[2,100]	[3,290] (0.5)
Selenium	5	2.0 U	2.0 U	2.0 U
Silver	4.1	1.0 U	1.0 U	1.0 U
Sodium		1,500 UJ	1,560 UJ	1,760 UJ
Thallium		2.0 U	2.0 U	2.0 U
Vanadium		1.0 U	1.0 U	1.0 U
Zinc	110	4.0 UJ	★ 1060 (0.02)	★ 720 (0.02)
Cyanide	5.2	3.0 U	3.0 U	3.0 U

- J The associated numerical value is an estimated quantity because Quality Control criteria were not met.
 UJ The reported amount is estimated because Quality Control criteria were not met. Element was not detected.
 U The analyte was not detected at reported concentration. (Qualified by laboratory software.)
 J) The associated numerical value was detected below the CRQL, but greater than the method detection limit and is therefore an estimate. Presence of the compound is reliable. (Qualified by laboratory software.)
 (.) Sample Quantitation Limit (SQL).
 ★ Sample values are \geq to the SQL, $\geq 3x$ background concentration and $\geq 5x$ all blank concentrations.
☐ Above SCDM benchmarks.

Source: URS 1996; EPA 1996

TABLE 13
1996 Expanded Site Inspection
Silver Creek Sediment Analytical Results
Concentrations in mg/kg

Sample ID: Case #: Traffic Report: Sample Location:	RA-SE-05 24008 MHDD97 Silver Creek background	RA-SE-06 24008 MHDD88 Silver Creek below tailings pile	RA-SE-07 24008 MHDD83 Silver Creek, just before confluence with Dolores River
Aluminum	3,820 J	★ 17,300 J (84.62)	5,500 J
Antimony	1.1 U	7.7 UJ	0.71 U
Arsenic	6.9 J	★ 52.6 J (5.13)	★ 22.0 J (0.47)
Barium	133	[58.0]	76.8
Beryllium	[0.45]	★ 16.9 (2.56)	[0.67]
Cadmium	0.38 U	★ 17.8 J (2.56)	6.4
Calcium	3,660 J	★ 16,900 J (12.82)	3810 J
Chromium	6.3	7.4 UJ	9.1
Cobalt	[3.3]	[6.1]	[5.3]
Copper	[6.7]	★ 123 (2.56)	★ 255 (0.24)
Iron	8,580 J	★ 225,000 J (23.05)	★ 30,400 J (2.13)
Lead	13.2 J	★ 2,000 J (2.56)	★ 1,540 J (0.24)
Magnesium	2,280	[1360]	4910
Manganese	343 J	★ 3,060 J (5.0)	★ 1,580 J (0.47)
Mercury	0.19 U	1.3 U	0.12 U
Nickel	[5.6]	★ 22.7 J (2.56)	9.6

TABLE 13
1996 Expanded Site Inspection
Silver Creek Sediment Analytical Results
Concentrations in mg/kg
(continued)

Sample ID: Case #: Traffic Report: Sample Location:	RA-SE-05 24008 MHDD97 Silver Creek background	RA-SE-06 24008 MHDD88 Silver Creek below tailings pile	RA-SE-07 24008 MHDD83 Silver Creek, just before confluence with Dolores River
Potassium	[1,720]	3,450 J	1,280 J
Selenium	0.76 U	★ 5.1 (5.13)	0.77 J
Silver	0.38 U	★ 3.9 J (2.56)	★ [2.3] (0.24)
Sodium	165 UJ	364 UJ	33.5 UJ
Thallium	0.76 U	11.9 UJ	1.5 UJ
Vanadium	[10.8]	[5.7]	11.9
Zinc	30.8 J	★ 48,300 J (12.5)	★ 2,010 J (1.18)
Cyanide	0.28 U	★ [2.2] (0.002)	0.18 U

Source: URS 1996

TABLE 14
1996 Expanded Site Inspection
Dolores River Surface Water Analytical Results - Total Metals
Concentrations in µg/l

Sample ID: Case #: Traffic Report #: Sample Location: Location Description:	SCDM AWQC	2352701 24008 MHCQ94 RA-SW-01 Background on Dolores River	2350424 24008 MHDD93 RA-SW-02 Adjacent to settling ponds on the Dolores River	2350421 24008 MHDD90 RA-SW-03 Confluence of drainage from settling ponds and Dolores River	2350416 24008 MHDD85 RA-SW-04 Confluence of Silver Creek and the Dolores River	2350409 24008 MHDD78 RA-SW-08 1.7 miles downstream of outfall 002 on the Dolores River	2350412 24008 MHDD81 RA-SW-09 1.9 miles downstream of outfall 002 on the Dolores River	2350401 24008 MHDD70 RA-SW-10 2.8 miles downstream of outfall 002 on the Dolores River	2350402 24008 MHDD71 RA-SW-11 5.8 miles downstream of outfall 002 on the Dolores River	2350408 24008 MHDD77 RA-SW-27 Duplicate of RA-SW-11
Aluminum		46.5 UJ	★ 492 J (0.2)	56.3 UJ	49.5 UJ	★ 349 (0.2)	[42.1]	[61.2]	[131]	[35.1]
Antimony		3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Arsenic	190	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Barium		[61.2]	[64.5]	[38.4]	[57.9]	[58.5]	[58.0]	[60.7]	[73.8]	[73.7]
Beryllium		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Cadmium	1.1	1.0 U	1.0 U	[1.0]	[1.1]	[1.1]	1.0 U	1.0 U	1.0 U	1.0 U
Calcium	11	34,800	39,100	★ 118,000 (5.0)	51,000	51,700	52,400	50,900	51,700	51,800
Chromium		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Cobalt		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Copper	12	1.0 U	[1.8]	[3.0] (0.025)	1.0 U	★ [8.0] (0.025)	[1.1]	[1.1]	[1.3]	[1.2]
Iron	1,000	24.2 J	★ 772 (0.1)	★ 242 (0.1)	★ 82.8 J (0.1)	★ 1,310 (0.1)	★ 124 J (0.1)	★ 114 J (0.1)	★ 152 (0.1)	★ 86.8 J (0.1)
Lead	3.2	1.0 U	[1.5]	1.0 U	11.3	[1.3]	1.0 U	3.3 (0.003)	1.0 U	1.0 U
Magnesium		5,320	5,770	12,200	6,550	7,430	6,940	6,760	6,700	6,840
Manganese		17.7	★ 103 (0.015)	★ 450 (0.015)	★ 126 (0.015)	★ 359 (0.015)	★ 137 (0.015)	★ 113 (0.015)	★ 80.5 (0.015)	★ 79.7 (0.015)
Mercury	0.012	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	160	1.0 U	1.0 U	[1.4]	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Potassium		3,120 J	[3,820]	[3,130]	834 U	[3,220]	[3,060]	[3,360]	[2,520]	[2,310]
Selenium	5	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Silver	4.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sodium		[1,950]	2,070	5,140	[2,270]	[2,740]	[2,730]	[2,650]	[2,590]	[2,740]
Thallium		2.0 U	2.0 U	[2.3]	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vanadium		1.0 U	[1.4]	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Zinc	110	4.5 UJ	10.0 UJ	★ 198 (0.03)	★ 85.9 (0.02)	★ 307 (0.02)	★ 81.0 (0.02)	★ 73.3 (0.02)	★ 99.2 (0.02)	★ 62.5 (0.02)
Cyanide	5.2	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 UJ	3.0 U	3.0 U

J The associated numerical value is an estimated Quantity because Quality Control criteria were not met.

UJ The reported amount is estimated because Quality Control criteria were not met. Element was not detected.

U The analyte was not detected at reported concentration. (Qualified by laboratory software.)

[] The associated numerical value was detected below the CRQL, But greater than the method detection limit and is therefore an estimate. Presence of the compound is reliable. (Qualified by laboratory software.)

() Sample Quantitation Limit (SQL)

★ Sample values are ≥ to the SQL, ≥ 3x background concentration and ≥ 5x all blank concentrations.

Source: URS 1996; EPA 1996

TABLE 15
1996 Expanded Site Inspection
Dolores River Sediment Analytical Results
Concentrations in mg/kg

Sample ID: Case #: Traffic Report #: Sample Location: Location Description:	2352702 24008 MHCQ95 RA-SE-01 Upstream of site influences on the Dolores River	2350425 24008 MHDD94 RA-SE-02 Adjacent to tailings piles on the Dolores River	2350422 24008 MHDD91 RA-SE-03 Confluence of drainage from settling ponds and the Dolores River	2350417 24008 MHDD86 RA-SE-04 Confluence of Silver Creek and the Dolores River	2350410 24008 MHDD79 RA-SE-08 1.7 miles downstream of outfall 002 on the Dolores River	2350411 24008 MHDD80 RA-SE-09 1.9 miles downstream of outfall 002 on the Dolores River	2350404 24008 MHDD73 RA-SE-10 2.8 miles downstream of outfall 002 on the Dolores River	2350403 24008 MHDD72 RA-SE-11 5.3 miles downstream of outfall 002 on the Dolores River
Aluminum	4,630 J	6,300 J	2,650 J	3,220 J	6,240 J	7,020 J	4,480 J	3,080 J
Antimony	0.85 U	0.81 U	0.78 U	1.1 U	[1.3]	1.0 U	1.3 U	0.91 U
Arsenic	25.1 J	9.8 J	6.2 J	9.2 J	16.5 J	18.2 J	10.5 J	6.4 J
Barium	79.3	72.6	52.9	[43.0]	[47.8]	117	90.8	[60.2]
Beryllium	0.45 UJ	[0.55]	[0.51]	0.37 U	[0.89]	[0.76]	[0.58]	[0.40]
Cadmium	[0.62]	0.27 U	[0.67]	[0.62]	[1.4]	4.2	[1.1]	[1.2]
Calcium	26,900 J	5,130 J	5,490 J	1,710 J	2,460 J	15,500 J	23,100 J	13,900 J
Chromium	5.2	8.2	2.8	[3.7]	7.5	9.2	6.3	4.3
Cobalt	[5.0]	[5.4]	[5.2]	[4.8]	[4.9]	[8.9]	[5.0]	[3.4]
Copper	12.1	35.6	8.1	25.9	★ 112 (0.28)	★ 66.5 (0.34)	27.3	20.2
Iron	15,500 J	15,200 J	7,700 J	10,200 J	25,200 J	22,200 J	14,900 J	9,350 J
Lead	69.8 J	28.4 J	14.5 J	192 J	★ 223 J (0.28)	★ 277 J (0.34)	65.2 J	52.1 J
Magnesium	3,310	3,680	2,090	[1,840]	3,760	6460	6,780	2,980
Manganese	400 J	504 J	966 J	821 J	596 J	★ 1,210 J (0.67)	322 J	478 J
Mercury	0.14 U	0.14 U	0.13 U	0.19 U	0.14 U	0.17 U	0.21 U	0.15 U
Nickel	[8.9]	11.2	[7.6]	[6.3]	[9.7]	16.1	[14.8]	[7.4]
Potassium	1670	[1,330]	[755]	[1,400]	1,540	2,490	[1,660]	[1,330]
Selenium	0.56 U	0.66 J	0.52 U	0.74 U	0.56 U	0.67 U	[1.3]	0.61 U
Silver	0.28 U	[0.28]	0.26 U	0.37 U	[0.60]	[0.98] (0.34)	0.43 U	0.30 U
Sodium	74.1 UJ	198 UJ	98.5 UJ	204 UJ	73.1 UJ	47.7 U	116 UJ	71.1 UJ
Thallium	1.1 UJ	0.68 UJ	0.52 U	0.74 U	1.3 UJ	1.8 UJ	1.4 UJ	0.70 UJ
Vanadium	[12.4]	15.0	[7.2]	[9.1]	14.5	19.7	[12.9]	[8.6]
Zinc	133 J	107 J	131 J	103 J	★ 429 J (1.41)	★ 722 J (1.68)	232 J	247 J
Cyanide	0.21 U	0.20 U	0.19 U	0.28 U	0.21 U	0.25 U	0.32 U	0.23 U

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 UJ The reported amount is estimated because Quality Control criteria were not met. Element was not detected.
 U The analyte was not detected at reported concentration. (Qualified by laboratory software.)
 [] The associated numerical value was detected below the CRQL, but greater than the method detection limit and is therefore an estimate. Presence of the compound is reliable. (Qualified by laboratory software.)
 () Sample Quantitation Limit (SQL).
 ★ Sample value are \geq to the SQL, $\geq 3x$ the background concentration and $\geq 5x$ all blank concentrations.

Source: URS 1996

TABLE 16
2003 Targeted Brownfields Assessment
Surface Water Inorganic Analytical Results
 Concentrations are in $\mu\text{g/L}$

Metal	SCDM AWQC	RLP-DR-SW1 Dolores River - Background	RLP-DR-SW2 Dolores River adjacent to settling ponds	RLP-OC-SW1 Side channel of the Dolores River background	RLP-OC-SW2 Side channel of the Dolores River adjacent to settling ponds
Arsenic	190	17 U	17 U	17 U	17 U
Barium	-	66 J	66 J	76 J	64 J
Cadmium	1.1	2 U	2 U	2 U	2 U
Chromium	11	2 U	2 U	2 U	2 U
Copper	12	1.2 U	1.2 U	1.2 U	1.2 U
Iron	1,000	110	78	61	230
Lead	3.2	140 U	14 U	14 U	14 U
Manganese	-	19	82	16	150
Mercury	0.12	0.03 U	0.03 U	0.03 U	0.03 U
Zinc	110	7 J	6.3 J	12 J	44 J

J The associated numerical value was detected above the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL) or because Quality Control Criteria were not met. Presence of the analyte is reliable.

U Not detected at the reported value.

Source: CDPHE 2003c; EPA 1996

TABLE 17
1996 Expanded Site Inspection
Soil Analytical Results
Concentrations in mg/kg

Sample ID: Case #: Traffic Report #: Sample Location: Location Description:	SCDM Soil RDSC	SCDM Soil CRSC	2350423 24008 MHDD92 RA-SO-01 Background Sample from off-site location outside of site influences.	2350430 24008 MHDD99 RA-SO-02 Opportunity soil sample from residential property in Rico	2352715 24008 MHDA97 RA-SO-03 Opportunity soil sample from residential property in Rico	2352716 24008 MHDA98 RA-SO-04 Opportunity soil sample from residential property in Rico	2353402 24008 MHDB00 RA-SO-05 Opportunity soil sample from residential property in Rico	2353403 24008 MHDD34 RA-SO-06 Opportunity soil sample from residential property in Rico
Aluminum			8,950 J	7,900 J	7,750 J	9,250 J	3,230 J	8,700 J
Antimony	31		0.70 U	0.68 U	1.0 UJ	★ 3.1 UJ (0.73)	[0.80]	[1.8]
Arsenic	23	0.43	9.7 J	18.2 J	11.8	14.8	5.7	★ 21.4 (0.48)
Barium	5,500		143	125	205	167	74.5	176
Beryllium	390	0.15	[0.55]	[0.75]	0.72 UJ	1.4	[0.30]	[0.92]
Cadmium	39		4.7	★ 41.8 (0.23)	5.7	3.6	[0.57]	11.7
Calcium			4,700 J	3,770 J	8,330 J	4,040 J	2,550 J	4,260 J
Chromium	390		13.5	10.1	9.5	9.5	3.2	10.7
Cobalt			[6.4]	[10.6]	[5.5]	[4.5]	[3.1]	[11.1]
Copper			30.2	★ 331 (0.23)	37.4 J	★ 97.2 J (0.97)	17.9 J	★ 92.8 J (0.97)
Iron			15,600 J	25,900 J	13,000 J	14,600 J	7,870 J	24,800 J
Lead			221 J	★ 2,620 J	156 J	★ 673 J (0.24)	67.5 J	433 J
Magnesium			4,160	4,480	2,840	1,980	1,570	4,810
Manganese	11,000		623 J	★ 2,030 J (0.46)	717 J	597 J	399 J	★ 3,090 J (0.48)
Mercury	23		0.12 U	★ 1.7 (0.11)	0.20	★ 0.89 (0.12)	0.20	0.12 U
Nickel	1,600		9.8	10.3	[7.8]	[8.1]	[7.5]	13.3
Potassium			2,280	1,880	2,240	1,520	[804]	1470
Selenium	390		0.47 U	0.66 J	[1.2]	1.3	0.44 U	0.48 U
Silver	390		[1.0]	★ 9.4 (0.23)	[1.1]	★ 5.2 (0.24)	0.22 U	[1.1]
Sodium			33.3 U	32.4 UJ	96.3 UJ	★ 106 UJ (34.34)	[69.8]	[66.4]
Thallium			0.66 UJ	1.5 UJ	0.47 U	0.48 U	0.44 U	0.48 U
Vanadium	550		21.2	15.3	14.8	18.5	[9.9]	18.7
Zinc	23,000		499 J	★ 5,180 J (1.14)	724 J	528 J	109 J	★ 1,720 J (1.21)
Cyanide	1,600		[0.49]	[0.24]	[0.51]	0.98	0.89	[0.26]

J The associated numerical value is an estimated quantity because Quality Control criteria were not met.
 UJ The reported amount is estimated because Quality Control criteria were not met. Element was not detected.
 U The analyte was not detected at reported concentration. (Qualified by laboratory software.)
 [] The associated numerical value was detected below the CRQL, but greater than the method detection limit and is therefore an estimate. Presence of the compound is reliable. (Qualified by laboratory software.)
 () Sample Quantitation Limit (SQL)
 ★ Sample values are ≥ to the SQL, ≥ 3x background concentration and ≥ 5x all blank concentrations.
 □ Above SCDM benchmarks.

Source: URS 1996; EPA 1996

TABLE 18
1996 CDPHE/ARCO Soil Study
Soil Analytical Results
Concentrations in mg/kg

Sample ID:	Location	Description	Total Lead
RC-2A	Turin Construction Site (Undisturbed Colluvium)	0-23"	220
RC-2B		23-55"	75
RC-2C		55-78"	69
RC-2D		26"	1,200
RC-2E		26-50"	3,000
RC-2F		50-76"	3,600
RC-3 A	Silver Creek Alluvial Fan (replicate of expanded SI sample)	0-14"	5,600
RC-3B		14-28"	550
RC-3C		28-42"	660
RC-4A	Grandview Smelter (0-6")	South	2,200
RC-4B		East	7,000
RC-4C		North	240
RC-5A1	Highway 145 Road Cut (Unmineralized)	Limestone Outcrop	14
RC-5A2		Sandstone Outcrop	72
RC-5A3		Shale Unit	8.9
RC-5B		Hornblend Latite Porphyry	ND
RC-6A	Former Assay Building (Silver Creek Alluvial Fan) (2-8")	Fine Fraction	1,100
RC-6B		Coarse Fraction	340
RC-7A	Hillside near Former Acid Plant	350' south of lime plant	130
RC-7B		475' south of lime plant	86
RC-8A	Greenstone	10' chip	38
RC-8B		Soil derived from Greenstone bedrock	1,000
RC-9A	East of RC-3 to determine extent of anthropogenic Lead	0-24"	330
RC-9B		24-49"	670
RC-10A	Replicates	RC-5B	ND
RC-10B		RC-9B	430
RC-10C		RC-16A	110
RC-16A	Replicate of Phase II Sample RS-02	Block 1, Lots 36-40	110
RC-21A	Foundation Excavation Behind Church	0-11"	1,800
RC-21B		11-26"	1,300
RC-21C		26-40+"	2,300

ND Not detected.
 Source: CDPHE 1996

TABLE 19
2003 EPA ORD Soil Study
Soil and Sediment Analytical Results
Concentrations in mg/kg

Sample #	Location	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn
SCDM Soil RDSC			23	--	5500	390	--	39	--	390	--	--	--	--	11000
SCDM Soil CRSC		--	0.43	--	--	0.15	--	--	--	--	--	--	--	--	--
DR0528004	Dolores River	81	7	19	3042	1	1248	40	13	30	749	2173	3693	10508	3101
DR0528009	Shamrock	108	0	8	259	1	6843	62	9	20	414	3561	762	6744	3422
DR05280013	Soda St trees	63	7	11	1038	0	104	25	3	11	119	1652	2212	2870	423
DR05280016	Van? Shaft	28	0	15	138	4	2993	363	26	62	1297	1748	669	19836	1173
DR0529031D	Mo-81 Sr81	24	0	9	61	1	3748	80	9	28	522	4207	728	11244	4446
DR05290x1	Sed Silver Cr.	28	7	5	551	0	599	9	3	5	115	1110	792	2217	1190
DR05290x2	Sediment	7	0	7	685	0	2205	2	4	6	17	1114	1204	4176	464
DR05290x3	Sediment	5	1	6	470	0	1374	2	3	3	12	741	957	2809	304
DR05290x4	Sediment	4	4	7	255	1	888	2	2	3	9	393	642	1982	93

Sample #	Location	Mo	Na	Ni	P	Pb	S	Sb	Se	Si	Sn	Ti	Tl	V	Zn
SCDM Soil RDSC		390	--	1600	--	--									23000
SCDM Soil CRSC		--	--	--	--	--									--
DR0528004	Dolores River	7	247	27	737	5925	4424	3	ND	521	1	82	41	ND	7584
DR0528009	Shamrock	2	120	13	549	2487	3879	3	ND	322	ND	109	31	ND	8852
DR05280013	Soda St trees	4	169	7	825	6338	12617	1	ND	203	1	65	18	ND	3388
DR05280016	Van? Shaft	11	59	26	391	17402	3911	4	ND	635	1	31	67	ND	4610
DR0529031D	Mo-81 Sr81	9	48	15	217	10666	2512	3	ND	194	ND	24	36	ND	1734
DR05290x1	Sed Silver Cr.	2	132	6	254	699	2028	2	ND	121	ND	27	10	ND	1378
DR05290x2	Sediment	2	179	13	394	54	1052	2	ND	263	ND	8	15	ND	135
DR05290x3	Sediment	1	133	9	287	34	969	2	ND	216	ND	6	11	ND	89
DR05290x4	Sediment	2	142	7	146	26	611	3	ND	164	1	5	8	ND	34

☐ Above SCDM benchmarks.
 ND Not detected.
 SCDM Superfund Chemical Data Matrix
 RDSC Reference Dose Screening Concentration
 CRSC Cancer Risk Screening Concentration

Source: EPA 2003a.; EPA 1996.

TABLE 20
2003 Targeted Brownfields Assessment
Soil Inorganic Analytical Results
Concentrations are in mg/kg

Sample ID	Arsenic	Barium	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Zinc
SCDM RDSC	23	5,500	39	---	---	---	11,000	23	23,000
SCDM CRSC	0.43	--	----	---	---	---	---	---	---
North Rico Light Industrial Park Site									
RLP-SO1	1.2 U	140	1.9 J	25	17,000	110 J	300 J	0.0013 U	170 J
RLP-SO2	1.2 U	140	1.7 J	25	16,000	89 J	300 J	0.0011 U	150 J
RLP-SO3	1.2 U	130	1.6 J	34	15,000	94 J	260 J	0.0011 U	150 J
RLP-SO4	0.94 U	130	1.8 J	24	16,000	100 J	300 J	0.001 U	200 J
RLP-SO5A	0.9 U	220	2.6 J	39	15,000	290 J	430 J	0.001 U	410 J
RLP-SO5B	1.5 U	240	3.1 J	48	14,000	280 J	440 J	0.0013 U	440 J
RLP-SO6	0.73 U	160	5.4 J	120	13,000	170 J	230 J	0.0011 U	240 J
RLP-SO7	0.66 U	150	5.3 J	140	14,000	840 J	230 J	0.0011 U	310 J
RLP-SO8	0.94 U	170	6.2 J	110	16,000	160 J	280 J	0.0013 U	320 J
RLP-SO9	35	88	1.2 J	19	13,000	45 J	210 J	0.0011 U	54 J
RLP-SO10	34	130	3.7 J	26	14,000	120 J	260 J	0.001 U	190 J
County Maintenance Barn Site									
RMB-SO1	12	170	21 J	290	32,000	2,300 J	2,100 J	0.091	3,500 J
RMB-SO2	11	150	15 J	350	49,000	2,900 J	970 J	0.17	2,700 J
RMB-SO3	1.1	290	11 J	83	23,000	620 J	1,100 J	0.11	1,600 J
RMB-SO4	13	210	28 J	380	61,000	4,500 J	2,000 J	0.44	3,800 J

J The associated numerical value was detected above the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL) or because Quality Control Criteria were not met. Presence of the analyte is reliable.
 U Not detected at the reported value.
☐ Above SCDM benchmarks.

Source: CDPHE 2003

TABLE 21
1996 Expanded Site Inspection
Source and Groundwater Analytical Results
Concentrations in µg/L

Sample ID: Case #: Traffic Report #: Sample Location: Location Description:		2352712 24008 MHDA94 RA-WGW-01 (Total metals) Outfall of the St. Louis tunnel	2352705 24008 MHCQ98 RA-WGW-02 (Total metals) Drill hole discharge adjacent to the settling pond	2353401 24008 MHDA99 RA-GW-01 (Total metals) Upgradient Well in the Dolores River Valley (Background)	2353407 24008 MHDD36 RA-GW-01 (Dissolved metals) Upgradient Well in the Dolores River Valley (Background)
Aluminum	(Al)	1660	9.4 U	8.0 U	8.0 U
Antimony	(Sb)	3.0 U	3.0 U	3.0 U	3.0 U
Arsenic	(As)	[4.3]	33.9	2.0 U	2.0 U
Barium	(Ba)	[21.1]	[40.8]	[32.8]	[32.4]
Beryllium	(Be)	1.7 UJ	5.3	1.0 U	1.0 U
Cadmium	(Cd)	20.1	1.0 U	1.0 U	1.0 U
Calcium	(Ca)	262,000	615,000	75,900	76,600
Chromium	(Cr)	1.0 U	1.0 U	1.0 U	1.0 U
Cobalt	(Co)	[3.6]	1.0 U	1.0 U	[1.1]
Copper	(Cu)	215	1.0 U	4.0 U	4.0 U
Iron	(Fe)	15,200	6,680	10.0 U	10.0 U
Lead	(Pb)	21.3	1.0 U	1.0 U	1.0 U
Magnesium	(Mg)	21,000	89,500	5,950	5,750
Manganese	(Mn)	2770	1070	2.0 U	[2.3]
Mercury	(Hg)	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	(Ni)	[7.3]	2.7 J	1.0 U	1.0 U
Potassium	(K)	[4,860]	26,000	[3,360]	[4,680]
Selenium	(Se)	2.0 U	2.0 U	2.0 U	2.0 U
Silver	(Ag)	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 21
1996 Expanded Site Inspection
Source and Groundwater Analytical Results
Concentrations in $\mu\text{g/L}$
(continued)

Sample ID: Case #: Traffic Report #: Sample Location: Location Description:		2352712 24008 MHDA94 RA-WGW-01 (Total metals) Outfall of the St. Louis tunnel	2352705 24008 MHCQ98 RA-WGW-02 (Total metals) Drill hole discharge adjacent to the settling pond	2353401 24008 MHDA99 RA-GW-01 (Total metals) Upgradient Well in the Dolores River Valley (Background)	2353407 24008 MHDD36 RA-GW-01 (Dissolved metals) Upgradient Well in the Dolores River Valley (Background)
Sodium	(Na)	8,930	64,700	[1,350]	[2,250]
Thallium	(Tl)	2.0 U	5.0 J	2.8 UJ	2.0 U
Vanadium	(V)	1.0 U	1.0 U	1.0 U	1.0 U
Zinc	(Zn)	4,100	77.9	73.3	76.2
Cyanide	(CN)	3.0 U	3.0 U	3.0 U	NR

J The associated numerical value is an estimated quantity because quality control criteria were not met.

U The analyte was not detected at reported concentration (qualified by laboratory software).

UJ The associated numerical value is an estimated quantity because quality control criteria were not met. The analyte was not detected.

[The associated numerical value was detected below the CRDL, but greater than the method detection limit and is therefore an estimate (qualified by laboratory software). Presence of the compound is reliable.

NR No result reported by laboratory.

Source: URS 1996

TABLE 22
2003 Targeted Brownfields Assessment
Groundwater Inorganic Analytical Results
 Concentrations are in $\mu\text{g/L}$

Sample ID	Arsenic	Barium	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Zinc
SCDM MCL	10	2000	5.0	1300	--	15	--	2.0	--
SCDM RDSC	11	2600	18	--	--	--	5100	11	11000
SCDM CRSC	0.057	--	--	--	--	--	--	--	--
North Rico Light Industrial Park Site									
RLP-GW1	17 U	58 J	2 U	1.2 U	160	14 U	0.5 U	0.03 U	12 J
RLP-GW2	17 U	67 J	2 U	1.2 U	1,100	14 U	2,800	0.03 U	64 J
RLP-GW3	17 U	17 J	2 U	1.2 U	95	14 U	430	0.03 U	380 J
RLP-GW4	17 U	39 J	2 U	1.2 U	2,300	14 U	1,700	0.03 U	73 J
RLP-GW5	17 U	19 J	2 U	1.2 U	4,600	14 U	4,700	0.03 U	7,100 J
RLP-GW6	17 U	33 J	15	5	630000 J	14 U	42000	0.03 U	4,700 J
RLP-GW7	17 U	15 J	76	1.2 U	180	14 U	840	0.03 U	670 J
RLP-GW8	0.22	30 J	2 U	1.2 U	41000	14 U	8,100	0.03 U	220 J
County Maintenance Barn Site									
RMB-GW1	17 U	350 J	2 U	1.2 U	18000	14 U	2,300	0.03 U	220
RMB-GW2	17 U	120 J	2 U	1.2 U	42000	14 U	14,000	0.03 U	310
RMB-GW3	17 U	200 J	2 U	1.2 U	7,700	14 U	1,400	0.03 U	24
RMB-GW4	17 U	120 J	2 U	1.2 U	33,000	14 U	7,700	0.03 U	210
RMB-GW5	17 U	52 J	2 U	1.2 U	25,000	14 U	9,700	0.03 U	3,800

Shaded values reflect a concentration greater than or equal to one of the listed SRO's or a CDPHE MCL, whichever may be applicable.

J The associated numerical value was detected above the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL) or because Quality Control Criteria were not met. Presence of the analyte is reliable.

U Not detected at the reported value.

▢ Above SCDM benchmarks.

Source: CDPHE 2003.

TABLE 23
1995 Phase II Environmental Site Assessment
Composite Soil Analytical Results
Concentrations in mg/kg

Sample ID:	Location	Copper	Lead	Arsenic	Mercury	Cadmium	Zinc
SCDM	Soil RDSC	-	-	23	23	39	23,000
SCDM	Soil CRSC	-	-	0.43			
Method		6010	6010	6010	7471	6010	6010
Ada North	Little Ada tract north in south Rico; native soil; 0-2 in.		77	9.8		1 U	120
BK 10	Block 10 in south Rico; native soil; 0-2 in.		190	10 U		1.6	360
BK 11	Block 11 in south Rico; native soil; 0-2 in.		62	10 U		1 U	150
BK 38	Block 38 in south Rico; native soil; 0-2 in.		84	10 U		1 U	160
BK 39	Block 39 in south Rico; native soil; 0-2 in.		96	14		1 U	160
DOT 1	na		0 U	0 U	0 U	0.08	
DOT 2	na		0 U	0 U	0 U	0.05	
DOT 3	na		1.7	0 U	0 U	0.07	
Group Tract	Group tract in south Rico; native soil; 0-2 in.		260	13		2.1	500
Hillside #2	Hillside claim in NW Rico; native soil, road base material; 0-2 in.		9100	24		16	2400
Hillside	Hillside claim in NW Rico; native soil, road base material; 0-2 in.		2800	26		23	3400
Home	Home claim in west Rico; native soil, road base material; 0-2 in.		300	21		4.6	780
Lots 17-20	Block 1, lots 17-20; fill material; 0-2 in.		830	10 U		9.5	2000
Patrick	Warner K. Patrick tract in NE Rico; native soil w/ orange stain; 0-2 in.		9300	10		2.1	970
RA-01	Silver Creek downgradient of Argentine tailings impoundments; alluvium, mine waste; 0-4 in.	190	180	50	0 U	10	1400
RP-01	Laura Mine site 0.5 mile east of Rico; mine waste spoil pile, mineralized wastes; 0-2 in.	590	4.3	0 U	0 U	60	9000
RP-01	Laura Mine site 0.5 mile east of Rico; mine waste spoil pile, mineralized wastes; 0-2 in.		8500	74	0.4	0.66	

TABLE 23
1995 Phase II Environmental Site Assessment
Composite Soil Analytical Results
Concentrations in mg/kg
(continued)

Sample ID:	Location	Copper	Lead	Arsenic	Mercury	Cadmium	Zinc
SCDM	Soil RDSC	-	-	23	23	39	23,000
SCDM	Soil CRSC	-	-	0.43			
Method		6010	6010	6010	7471	6010	6010
RP-03	Block 20, lots 30 and 31; former Atlantic Cable mine site; mineralized rock and soil; 0-3 in.	570	7000	26	0.4	84	13000
RP-04	Shamrock claim; mine waste dump, 0-6 in.					0 U	
RS-01	Coniferous forest south side of Rico; native soil; 0-2 inches	27	100		0 U	2 U	190
RS-02	Block 1, lots 39 and 40; fill material, possible mine waste; 0-4 inches	190	1500	62	2.5	7	990
RS-04	Block 14, lots 36-40; fill material; 0-7 inches	170	160	26	0.8	10	1500
RS-05	Atlantic Cable Subdivision, lots 41-44; native soil; 0-2 in.	33	280	20 U	0 U	6	880
RS-06	Floodplain west of former sulfuric acid plant; native soil; 0-2 in.	53	90	22	1.7	3	200
RS-08	Downhill from Spine mine; native soil; 0-2 in.	21	140	20 U	0 U	2 U	220
RS-10	East of former acid plant; native soil; 0-2 in.	54	160	20	0 U	3	240
RS-12	Block 12, lots 31 and 36; Block 25 lots 5 and 11; alluvium, mine waste rock; 0-2 in.	330	5200	37	0 U	19	2400
RS-13	Homestake claim in north Rico; native, slag, mine waste rock, and coal unit; 0-2 in.	660	4800	47	0.6	20	4000
RS-15	Block 21, lot 1; mine waste fill material, native soil; 0-6 in.	500	3900	21	0.5	57	7700
RS-16	Block 2, lots 9-12; fill material, possibly w/ native soil; 0-8 in.	84	750	20 U	0.4	6	1300
RS-17	Warner K. Patrick tract; native soil; 0-2 in.	66	540	20 U	0 U	7	750
RS-18	Block 1, lots 16-20; fill material and native soil; 0-5 in.	110	1400	20 U	0.5	13	2400
RS-19	Wetlands west of Block 28; 0-2 in.	260	12000	28	0.5	23	3700
RS-20	Wetlands west of Block 27; 0-2 in.	330	2000	22	0.8	17	2400
RS-21	Block 20, lots 21-27; disturbed native soil; 0-2 in.	240	3400	20 U	0.3	38	5300

TABLE 23
1995 Phase II Environmental Site Assessment
Composite Soil Analytical Results
Concentrations in mg/kg
(continued)

Sample ID:	Location	Copper	Lead	Arsenic	Mercury	Cadmium	Zinc
SCDM	Soil RDSC	-	-	23	23	39	23,000
SCDM	Soil CRSC	-	-	0.43			
Method		6010	6010	6010	7471	6010	6010
RS-22	Block 19, lots 13-20; native soil; 0-2 in.	200	2000	20 U	0.6	33	4400
RS-23	Block 19, lots 7-9 and 29-36; alluvium; 0-2 in.	160	800	29	0 U	11	2000
RS-24	Block 28, lots 6-20; disturbed soil; 0-2 in.	190	1000	30	0.4	11	1700
RS-25	Former train depot site; clinkers, fill material, alluvium; 0-2 in.	200	1200	40	0 U	4	1100
RS-26	Dump debris along Dolores River; 0-6 in.	310	1600	27	0.9	9	4000
RS-27	Wetlands east of A.E. Arms tract; native soil; 0-2 in.		500	25	0 U	14	1500
RS-28	Block 25, lots 1-4; disturbed alluvium, possibly mine waste; 0-2 in.		3500	20 U	0.3	17	2600
RW-01	na	0 U	0 U	0 U	0 U	0 U	.22
RW-02	na	12	0 U	0 U	0 U	0.33	40
RW-03	na	0 U	0 U	0 U	0 U	0 U	.39
RW-04	na	0 U	0 U	0 U	0 U	0 U	0.08
RW-05	na	0 U	0 U	0 U	0 U	0 U	0 U
Sam Patch	Sam Patch claim in west Rico; fill, mine waste; 0-2 in.		12000	26		17	2900
School Lots	Block 2, lots 9-12; fill material; 0-2 in.		650	10 U		6.6	1500
Smuggler	Smuggler claim in NW Rico; native soil, road base materials; 0-2 in.		420	12		2.2	460
SP-01	na	150	880	20 U	16	9	1800
SP-02	na	190	1100	20 U	1.4	13	2100
SP-03	na	180	1050	22	0 U	7	1100
SP-04	na	40	760	29	0 U	5	100
SP-06	na	45	380	20 U	0 U	3	630

TABLE 23
1995 Phase II Environmental Site Assessment
Composite Soil Analytical Results
Concentrations in mg/kg
(continued)

Sample ID:	Location	Copper	Lead	Arsenic	Mercury	Cadmium	Zinc
SCDM	Soil RDSC	-	-	23	23	39	23,000
SCDM	Soil CRSC	-	-	0.43			
Method		6010	6010	6010	7471	6010	6010
T-01	Former city landfill; 6 ft depth.	9	20	20 U	0 U	2 U	65
T-02	Former city landfill; 14 ft depth.	74	380	36	0 U	4	640
T-03	Block 1, lots 36-38; fill material, possible mine waste; 0-8 ft.	230	21	0 U	0 U	0.08	1300
T-03	Block 1, lots 36-38; fill material, possible mine waste; 0-8 ft.		7700	49	0.4	6	
Trench 1	Block 1, lot 40; fill material, 3 ft.		830	10 U		6	1400
Trench 2	na		230	10 U		1 U	410
Yankee Boy	Yankee Boy claim in NW Rico; native soil, sediment; 0-2 in.		6500			12	2100

SCDM Superfund Chemical Data Matrix
 RDSC Reference Dose Screening Concentration
 CRSC Cancer Risk Screening Concentration
 na Not available in WALSH 1995.
 U Not detected at the reported value.

Source: WALSH 1995; EPA 1996

TABLE 24
Town of Rico Municipal Drinking Water Quality Data - Analytical Results
Concentrations in mg/L (ppm)

Sample Date:		SCDM (Drinking Water)			03/02/1992	12/20/1995	03/28/1996	03/19/1997	03/11/1998	07/27/1999	03/13/2000	03/05/2001	02/14/2002	03/04/2003
Element	Abbrev.	MCL	RDSC	CRSC										
Antimony	(Sb)	0.006	0.015	-	-	<0.005	<0.005	<0.003	<0.003	<0.001	<0.001	<0.005	<0.003	BDL
Arsenic	(As)	0.00005	0.011	-	ND	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.005	BDL
Barium	(Ba)	2.0	2.6	-	0.12	<0.500	<0.500	<1.000	<1.000	0.095	0.13	0.12	0.12	0.120
Beryllium	(Be)	0.004	0.18	0.000020	-	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	BDL
Cadmium	(Cd)	0.005	0.018	-	ND	<0.002	<0.002	<0.002	<0.002	<0.0001	<0.0001	<0.0001	<0.0001	BDL
Chromium	(Cr)	0.1	0.18	-	ND	<0.020	<0.020	<0.050	<0.050	<0.001	0.004	0.003	0.0014	BDL
Fluoride	(F)	-	-	-	ND	<0.100	<0.100	<0.100	<0.400	<0.05	0.06	<0.05	0.081	BDL
Lead	(Pb)	0.015	-	-	ND	<0.005	<0.005	<0.005	<0.005	0.002	NT	NT	NT	-
Mercury	(Hg)	0.002	0.011	-	ND	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	BDL
Nickel	(Ni)	-	0.73	-	-	<0.010	<0.010	<0.050	<0.050	<0.001	NT	<0.005	<0.005	BDL
Selenium	(Se)	0.05	0.18	-	ND	<0.001	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	BDL
Silver	(Ag)	-	0.18	-	NT	ND	NT	NT	NT	-	-	-	-	-
Sodium	(Na)	-	-	-	1.9	1.9	1.8	1.9	1.8	1.0	1.8	1.8	1.8	1.76
Sulfate	(SO ₄)	-	-	-	-	14	16	13	14	7	NT	NT	NT	-
Thallium	(Tl)	0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	BDL
Cyanide	(CN)	0.2	0.73	-	-	NT	NT	NT	NT	NT	NT	NT	NT	-

NT Not tested.
 BDL Below laboratory detection limit.
 ND None detected.
 SCDM Superfund Chemical Data Matrix
 MCL Maximum Contaminant Level
 RDSC Reference Dose Screening Concentration
 CRSC Cancer Risk Screening Concentration

Sources: CDPHE 2003 (Compliance Assurance and Data Management Unit - WQCD - Water Quality Data for ID 117700 - Town of Rico, Colorado); and EPA 1996.

TABLE 25
2003 Targeted Brownfields Assessment - Soil Organic Sample Results
Concentrations in $\mu\text{g/kg}$ (ppb)

Sample ID#:	SCDM Soil Pathway		County Maintenance Barn Soil Samples			
	RDSC	CRSC	RMB-SO1	RMB-SO2	RMB-SO3	RMB-SO4
Volatile Organic Compounds						
None Detected	-	-	-	-	-	-
PAH Compounds						
Anthracene	23,000,000	-	39 U	42 UJ	42 U	62
Benzo(a)anthracene	-	880	39 U	42 UJ	42 U	200
Benzo(a)pyrene	-	88	32 U	34 UJ	35 U	200
Benzo(b)fluoranthene	-	880	28 U	30 UJ	30 U	280
Benzo(g,h,i)perylene	-	-	42 U	44 UJ	45 U	210
Benzo(k)fluoranthene	-	8,800	37 U	39 UJ	40 UJ	120
Chrysene	-	88,000	39 U	47 J	47	290
Fluoranthene	3,100,000	-	44 U	54 J	47 U	440
Fluorene	3,100,000	-	39 U	42 UJ	42 U	40
Indeno(1,2,3-cd)pyrene	-	880	36 U	38 UJ	38 U	150
Naphthalene	3,100,000	-	18 U	19 UJ	19 U	300
Phenanthrene	-	-	39 U	68 J	42 U	440
Pyrene	2,300,000	-	37 U	48 J	280	430
Pesticides						
DDD, 4,4'-	-	2,700	2.8 J	0.48 U	0.48 UJ	2.2 J
DDE, 4,4'-	-	1,900	0.55	1.9 J	0.66 J	0.38 J
DDT, 4,4'-	39,000	1,900	0.87 J	1.7 J	1.9 J	1.5 J
BHC, alpha-	-	100	2.1	0.31 U	0.31 UJ	0.29 U
BHC, beta-	-	360	1.2 J	1.8 J	0.62 UJ	1.1 J
BHC, delta-	-	-	1.0 J	2.8 J	0.51 UJ	0.72 J
Dieldrin	3,900	40	0.29 U	0.31 U	0.31 UJ	0.39 J
Endosulfan I	470	-	0.4	0.27 J	0.26 UJ	0.36 J
Endosulfan II	470	-	1.3 J	2.8 J	4.7	2.0 J
Endosulfan Sulfate	-	-	0.51 J	0.22 UJ	0.5 J	0.28 UJ
Endrin Aldehyde	-	-	1.0 U	1.1 U	1.9 J	1.6 J
gamma-BHC (Lindane)	2,300	490	0.99	2.6 J	0.81 UJ	0.75 U
gamma-Chlordane	-	-	0.61	0.6	0.54 UJ	0.50 U
Heptachlor Epoxide	1,000	70	0.66 U	0.78	0.70 UJ	0.64 U
Methoxychlor	390,000	-	1.4 U	23	1.5 UJ	1.4 U

☐ Above SCDM benchmarks
 J The associated numerical value is an estimated quantity because quality control criteria were not met. Presence of the analyte is reliable.
 U The analyte was not detected above the CRQL.

TABLE 26
2003 Targeted Brownfields Assessment - Groundwater Organic Analytical Results
Concentrations in µg/L (ppb)

Chemical Name	SCDM (Drinking Water)			RMB-GW1	RMB-GW2	RMB-GW3	RMB-GW4	RMB-GW5	RMB-GW21 Duplicate of RMB-GW5
	MCL	RDSC	CRSC						
VOCs									
Diesel Range Organics	-	-	-	0.55	0.032 U	0.032 U	0.032 U	0.032 U	0.032 U
1,2,4-Trimethylbenzene	-	-	-	0.93	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U
4-Isopropyltoluene	-	-	-	47	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Styrene	100	7,300	-	2.7	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U
Pesticides									
gamma-Chlordane	-	-	-	0.014 J	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U
Endrin Aldehyde	-	-	-	0.0069 U	0.0069 U	0.0069 U	0.0069 U	0.0025	0.0069 U

SCDM Superfund Chemical Data Matrix
 MCL Maximum Contaminant Level
 RDSC Reference Dose Screening Concentration
 CRSC Cancer Risk Screening Concentration
 J The associated numerical value was detected above the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL) or because Quality Control Criteria were not met. Presence of the analyte is reliable.
 U Not detected at the reported value.

APPENDIX A

Streamflow and Precipitation Graphs and Data



Water Resources

Data Category:

Surface Water

Geographic Area:

Colorado

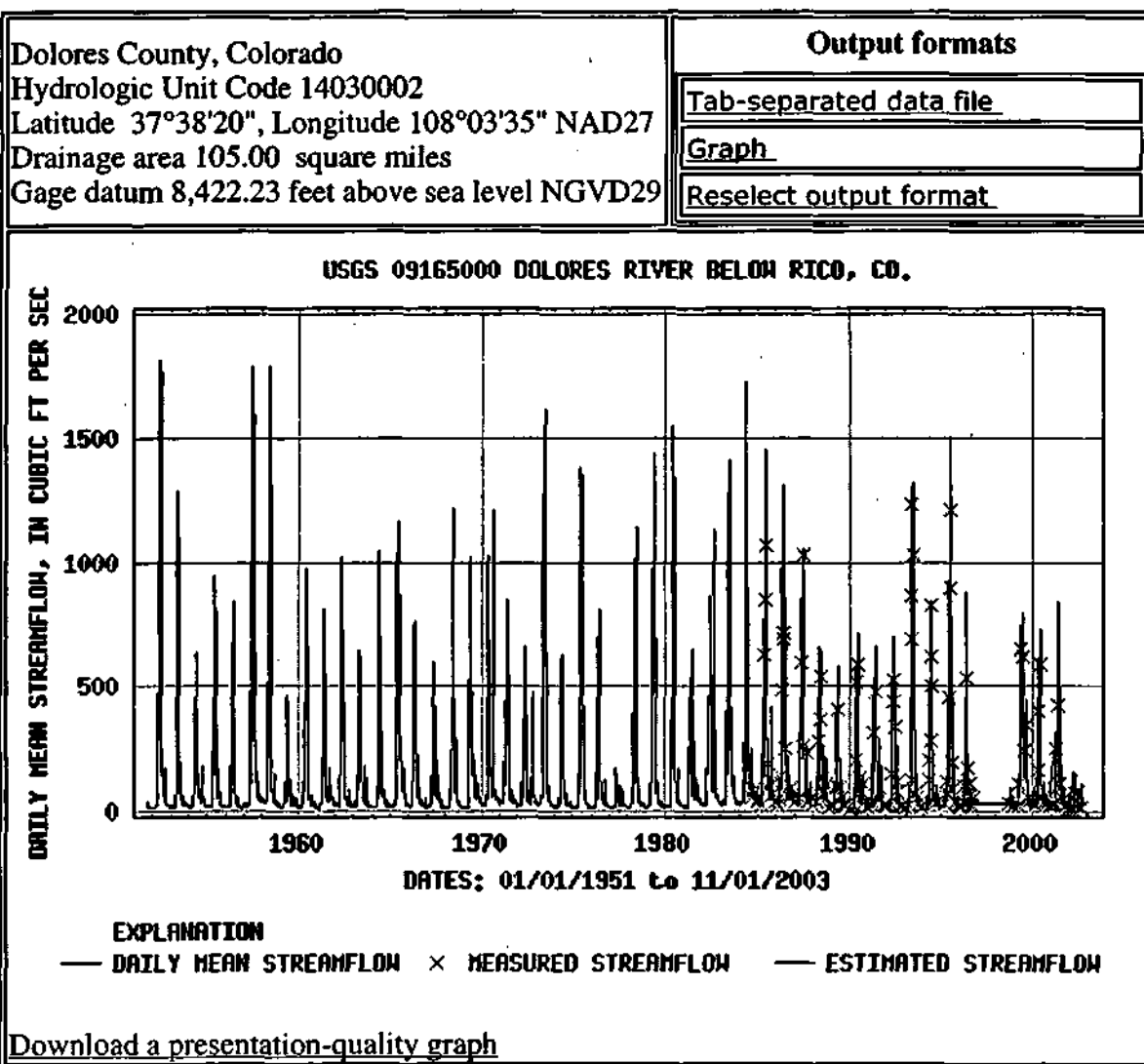


Daily Streamflow for Colorado

USGS 09165000 DOLORES RIVER BELOW RICO, CO.

Available data for this site

Surface-water: Daily streamflow

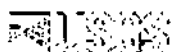
Questions about data gs-w-co_NWISWeb_Data_Inquiries@usgs.gov[Top](#)Feedback on this website gs-w-co_NWISWeb_Maintainer@usgs.gov[Explanation of terms](#)

Surface Water for Colorado: Daily Streamflow

<http://waterdata.usgs.gov/co/nwis/discharge?>

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Department of the Interior, U.S. Geological Survey



Water Resources

Data Category:

Surface Water

Geographic Area:

Colorado

GO

Calendar Year Streamflow Statistics for Colorado

USGS 09165000 DOLORES RIVER BELOW RICO, CO.

Available data for this site

Surface-water: Annual streamflow statistics

GO

Dolores County, Colorado
 Hydrologic Unit Code 14030002
 Latitude 37°38'20", Longitude 108°03'35" NAD27
 Drainage area 105.00 square miles
 Gage datum 8,422.23 feet above sea level NGVD29

Output formats

HTML table of all data

Tab-separated data

Reselect output format

Year	Annual mean streamflow, in ft ³ /s	Year	Annual mean streamflow, in ft ³ /s	Year	Annual mean streamflow, in ft ³ /s	Year	Annual mean streamflow, in ft ³ /s
1952	208	1964	97.2	1976	103	1988	102
1953	97.9	1965	209	1977	39.6	1989	91.2
1954	87.7	1966	110	1978	147	1990	86.6
1955	96.4	1967	86.1	1979	189	1991	105
1956	96.3	1968	137	1980	183	1992	116
1957	239	1969	155	1981	94.4	1993	179
1958	191	1970	138	1982	173	1994	101
1959	68.4	1971	122	1983	206	1995	187
1960	130	1972	99.9	1984	199	1999	163
1961	115	1973	200	1985	178	2000	93.0
1962	140	1974	80.5	1986	189	2001	120
1963	85.8	1975	184	1987	168		

Questions about data gs-w-co_NWISWeb_Data_Inquiries@usgs.govFeedback on this website gs-w-co_NWISWeb_Maintainer@usgs.gov

Surface Water data for Colorado: Calendar Year Streamflow Statistics

http://waterdata.usgs.gov/co/nwis/annual/calendar_year?
[Top](#)
[Explanation of terms](#)

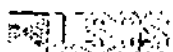
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USGS Water Resources of Colorado

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0.7 0.67 nadww01



Water Resources

Data Category:

Site Information

Geographic Area:

Colorado



Site Map for Colorado

USGS 09165000 DOLORES RIVER BELOW RICO, CO.

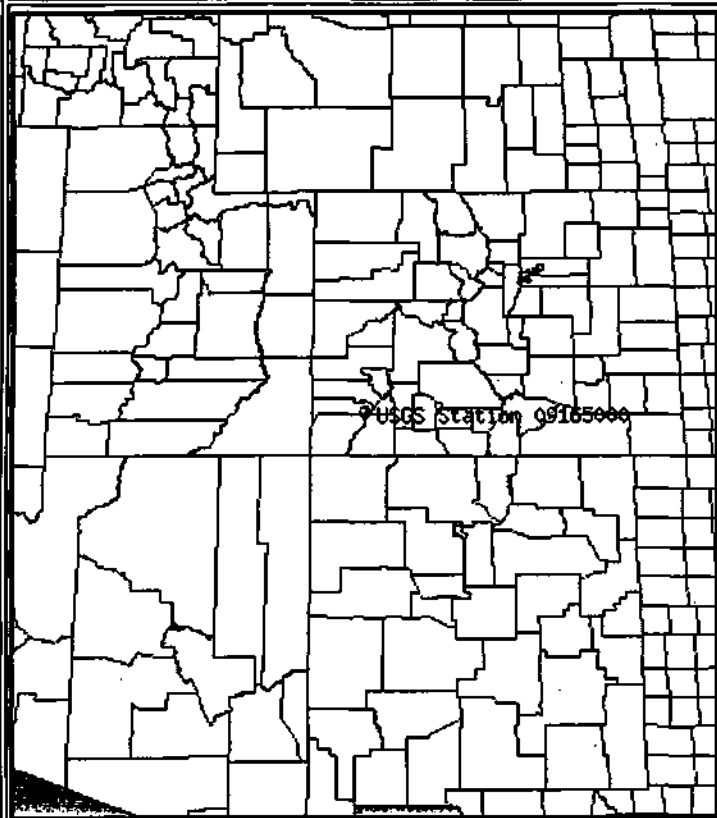
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Station site map

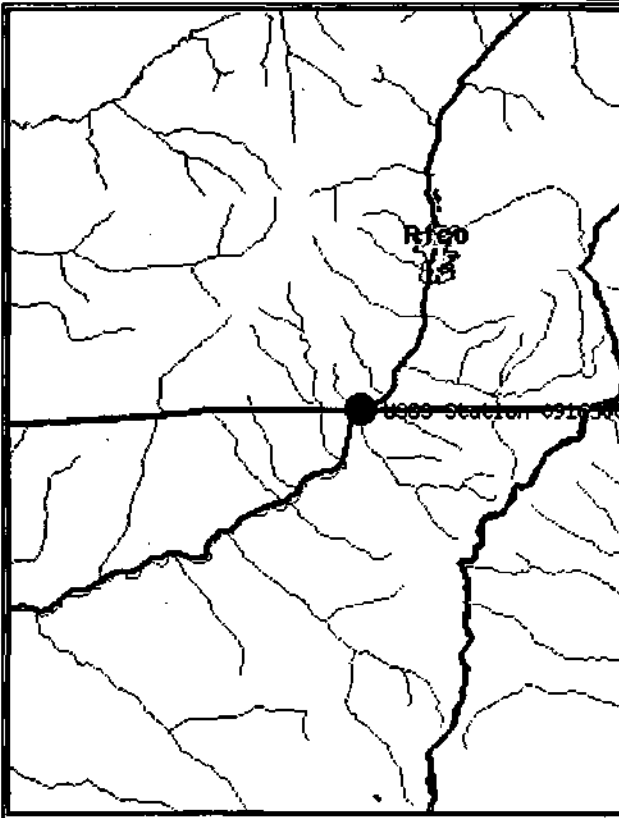


Dolores County, Colorado
Hydrologic Unit Code 14030002
Latitude 37°38'20", Longitude 108°03'35" NAD27
Drainage area 105.00 square miles
Gage datum 8,422.23 feet above sea level NGVD29

Location of the site in Colorado.



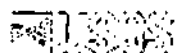
Site map.

ZOOM IN 2X, 4X, 6X, 8X, or ZOOM OUT 2X, 6X, 8X.Maps are generated by US Census Bureau TIGER Mapping Service.Questions about data gs-w-co_NWISWeb_Data_Inquiries@usgs.gov[Top](#)Feedback on this website gs-w-co_NWISWeb_Maintainer@usgs.gov[Explanation of terms](#)

NWIS Site Inventory for Colorado: Site Map

<http://waterdata.usgs.gov/co/nwis/nwismap?>

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Water Resources

Data Category:

Surface Water

Geographic Area:

Colorado



Monthly Streamflow Statistics for Colorado

USGS 09165000 DOLORES RIVER BELOW RICO, CO.

Available data for this site Surface-water: Monthly streamflow statistics



Dolores County, Colorado
 Hydrologic Unit Code 14030002
 Latitude 37°38'20", Longitude 108°03'35" NAD27
 Drainage area 105.00 square miles
 Gage datum 8,422.23 feet above sea level NGVD29

Output formats

HTML table of all data

Tab-separated data

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YEAR	Monthly mean streamflow, in ft ³ /s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1951										20.4	15.3	13.3
1952	12.0	11.0	18.0	152	693	1,169	247	77.5	53.4	26.8	20.5	18.8
1953	15.7	15.5	21.6	99.4	303	474	90.9	56.6	24.7	24.5	27.4	21.5
1954	17.3	15.5	17.0	178	372	159	66.9	40.8	61.9	75.2	24.8	19.7
1955	16.9	14.5	16.9	74.0	381	400	73.8	93.0	31.2	18.9	17.1	16.2
1956	16.1	15.6	39.3	138	476	328	51.6	32.1	17.1	14.5	12.1	13.7
1957	23.1	15.2	17.9	121	226	1,288	646	255	124	52.0	50.5	42.6
1958	37.7	31.6	35.7	202	1,015	717	89.6	44.6	43.8	28.3	21.6	15.9
1959	13.9	15.4	46.0	64.4	251	220	37.1	52.5	26.6	40.9	33.9	15.9
1960	17.4	17.9	42.1	238	444	591	83.0	36.2	28.8	30.9	19.4	14.9
1961	9.69	8.18	23.7	104	527	370	58.6	56.6	77.2	70.0	43.0	28.7
1962	26.5	30.5	22.9	242	519	535	151	46.3	36.3	35.0	22.0	17.4
1963	15.8	25.4	44.6	152	432	128	46.8	63.0	59.8	26.3	18.4	12.0
1964	11.0	11.0	11.0	44.1	485	311	78.5	103	43.3	25.7	20.5	18.0
1965	18.8	18.2	18.2	176	501	856	483	178	118	74.5	37.3	27.0
1966	21.3	19.3	46.5	187	554	261	74.2	46.0	32.0	25.4	18.1	23.2
1967	14.5	14.1	33.9	108	330	228	74.5	86.5	74.6	31.3	18.4	15.7
1968	15.4	16.0	26.6	63.7	376	767	142	149	37.5	25.3	18.8	13.5
1969	12.7	12.7	14.6	177	615	490	199	81.7	85.1	82.5	54.1	33.5
1970	25.1	23.6	21.5	60.7	589	369	117	88.0	209	66.8	44.3	35.9

1971	29.9	31.2	54.5	179	302	568	116	57.4	40.4	38.2	31.2	23.0
1972	20.9	20.8	72.2	160	312	269	49.2	31.0	38.5	133	57.6	33.7
1973	27.5	24.6	30.4	73.5	628	1,022	396	86.3	46.5	27.4	19.9	19.0
1974	17.4	15.9	27.3	66.7	453	197	63.7	37.6	21.8	22.5	21.1	15.5
1975	14.1	12.5	15.7	42.9	369	1,009	557	74.8	43.3	24.4	18.9	16.6
1976	14.8	16.0	24.9	82.4	413	444	79.5	44.7	46.5	38.6	21.6	15.0
1977	14.2	14.5	17.7	59.4	98.9	70.7	47.1	47.0	35.0	28.6	22.6	18.0
1978	16.0	15.0	28.0	167	463	818	135	40.6	24.8	21.3	21.3	15.6
1979	15.5	14.4	18.4	107	550	1,053	339	72.9	33.0	24.5	21.6	17.5
1980	14.5	14.3	14.4	102	416	1,179	264	65.4	54.9	31.2	25.5	20.6
1981	16.9	15.1	16.6	107	255	307	130	57.8	65.2	81.0	46.6	31.7
1982	25.8	24.2	26.9	137	400	663	210	216	224	71.2	38.0	32.6
1983	27.2	28.0	37.3	74.9	414	1,034	451	205	73.0	55.2	33.0	34.4
1984	31.2	33.7	51.2	133	846	707	178	149	72.5	81.1	56.1	39.7
1985	31.1	24.9	32.0	192	524	799	170	72.0	114	95.2	49.2	36.8
1986	32.5	32.5	59.4	154	620	767	241	76.6	84.1	87.6	65.9	39.5
1987	27.3	25.6	35.5	172	522	747	211	112	55.0	37.5	49.5	24.5
1988	18.7	19.0	36.5	119	348	353	91.6	71.5	85.5	42.3	25.2	19.8
1989	19.9	22.1	70.5	228	374	192	60.5	51.6	28.4	23.9	12.2	7.81
1990	7.74	8.54	17.0	53.5	287	340	92.3	57.8	52.8	72.4	35.4	12.3
1991	10.7	12.8	21.1	117	417	358	94.9	62.4	91.0	28.6	23.6	23.6
1992	17.0	14.2	25.8	172	504	372	118	60.8	37.6	24.7	21.3	15.7
1993	14.7	13.9	29.8	122	674	888	220	72.6	49.6	30.9	15.1	11.2
1994	8.00	7.49	27.4	91.4	427	417	59.5	33.5	43.0	45.0	28.9	19.3
1995	15.0	24.6	52.5	87.1	249	1,013	549	119	65.9	32.5	20.2	18.0
1996	15.1	17.3	27.9	128	522	141	59.2	29.7	38.9			
1998										40.8	41.4	23.7
1999	15.3	15.8	54.3	129	408	595	228	267	163	37.8	16.3	15.7
2000	14.8	16.4	27.3	191	492	165	45.1	41.4	37.4	33.3	27.8	21.0
2001	21.0	22.0	36.6	156	611	315	80.5	92.7	29.0	25.0	20.2	27.9
2002	21.8	18.1	20.0	110	108	36.3	16.7	14.2	34.8			
Mean of monthly streamflows	18.7	18.5	31.2	128	451	541	167	81.8	61.5	43.5	29.1	21.8

Surface Water data for Colorado: Monthly Streamflow Statistics

<http://waterdata.usgs.gov/co/nwis/monthly?>

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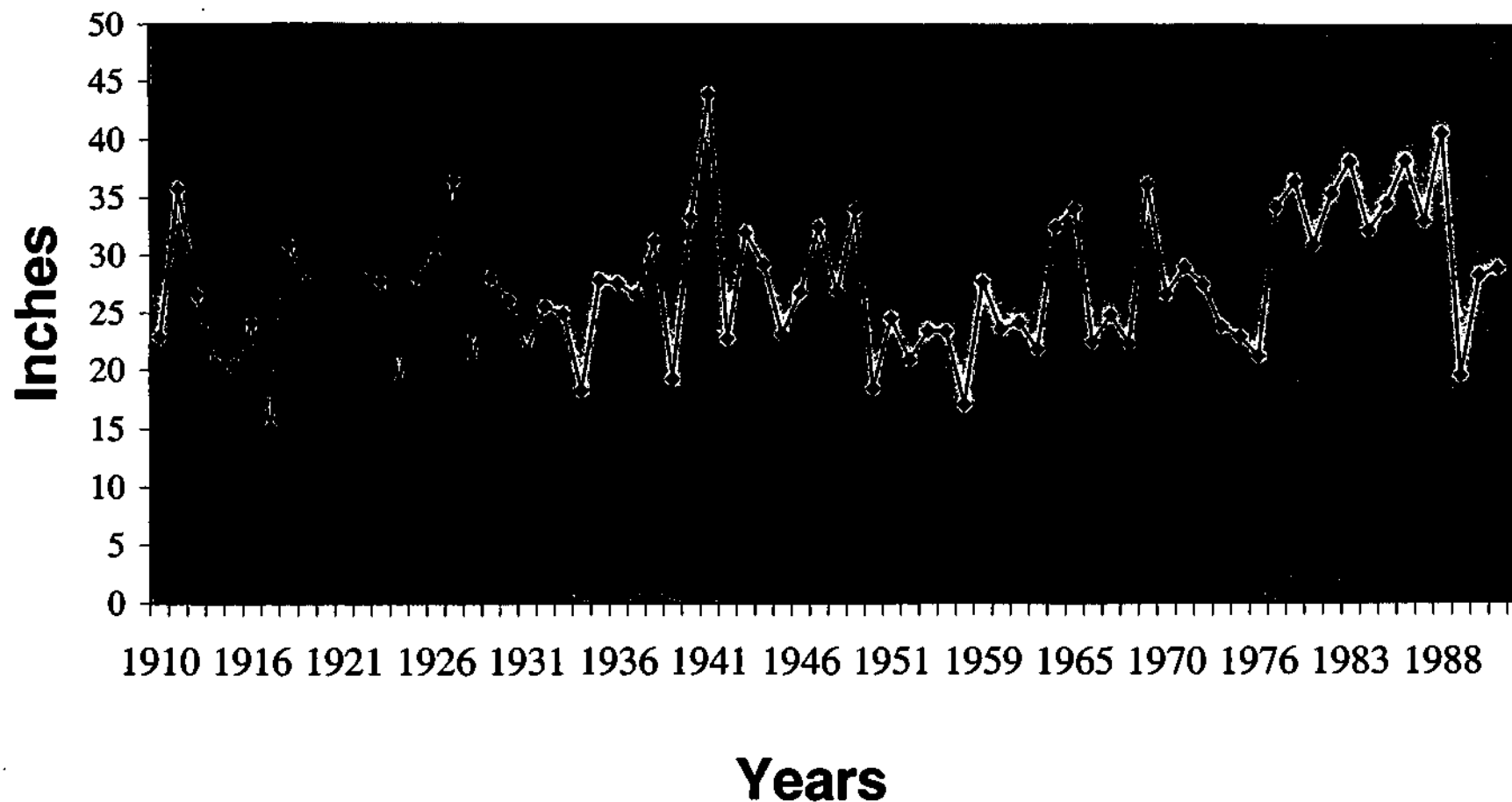
Department of the Interior, U.S. Geological Survey

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Rico Precipitation - 1910 through 1992



(No data available for 1912, 1955, 1957, 1958, 1960, 1975, 1977, 1979, and 1991)
Source: NCDC On-Line Monthly Precipitation Data for the National Weather Service station in Rico,
Colo. <http://www.ncdc.noaa.gov/oa/climate/online/coop-precip.html>